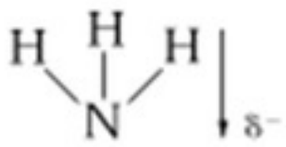
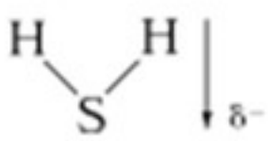
Bioquímica Geral
RFM0004

Proteínas:
Função

Profa. Dra Tie Koide
Departamento de Bioquímica e Imunologia
FMRP-USP

table 4–3

Solubilities of Some Gases in Water

Gas	Structure*	Polarity	Solubility in water (g/L)†
Nitrogen	N≡N	Nonpolar	0.018 (40 °C)
Oxygen	O=O	Nonpolar	0.035 (50 °C)
Carbon dioxide	$\overset{\delta^-}{\leftarrow}\quad\overset{\delta^-}{\rightarrow}$ O=C=O	Nonpolar	0.97 (45 °C)
Ammonia		Polar	900 (10 °C)
Hydrogen sulfide		Polar	1,860 (40 °C)

*The arrows represent electric dipoles; there is a partial negative charge (δ^-) at the head of the arrow, a partial positive charge (δ^+; not shown here) at the tail.

†Note that polar molecules dissolve far better even at low temperatures than do nonpolar molecules at relatively high temperatures.

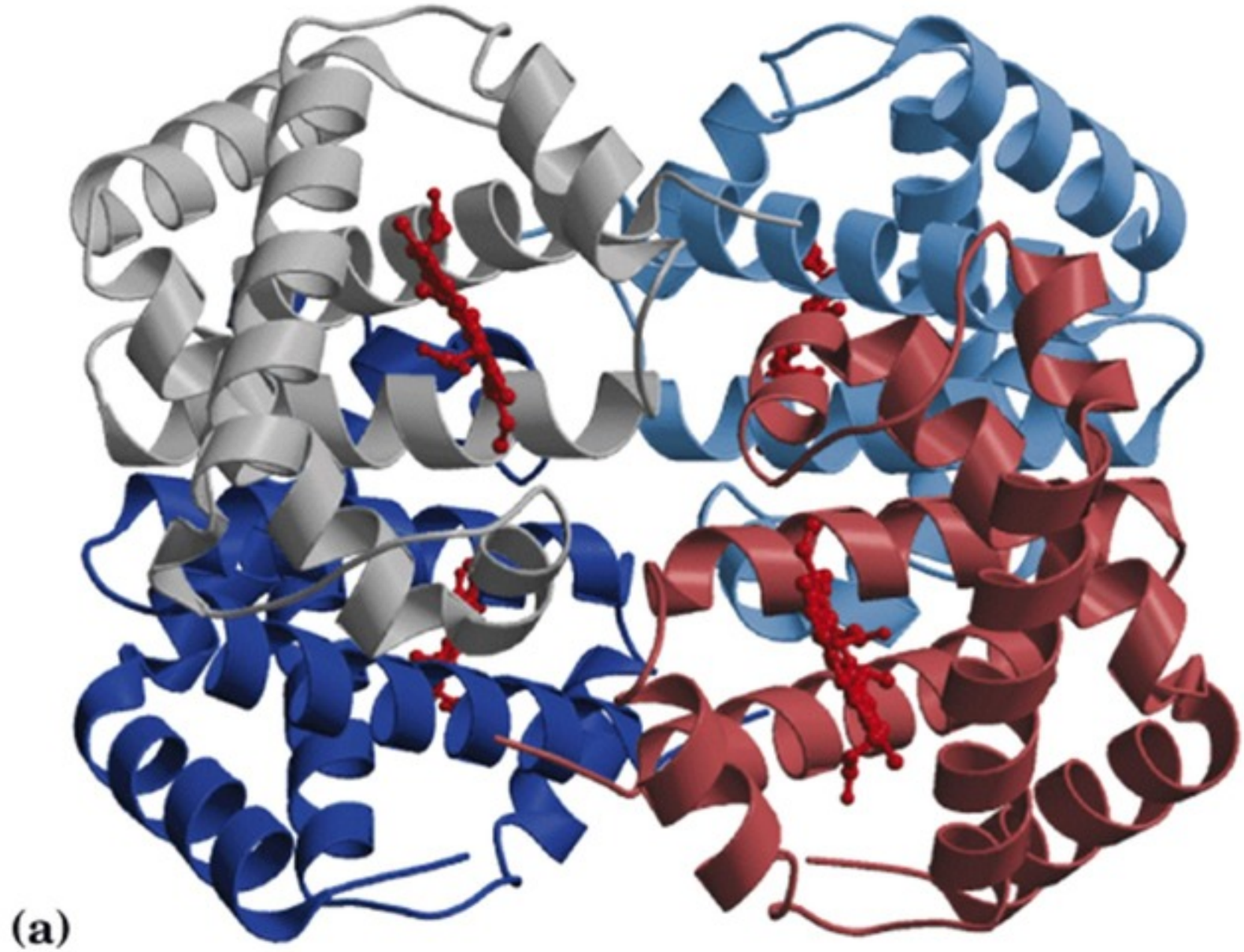
Chapter 7 Opener part 1
Biochemistry, Sixth Edition

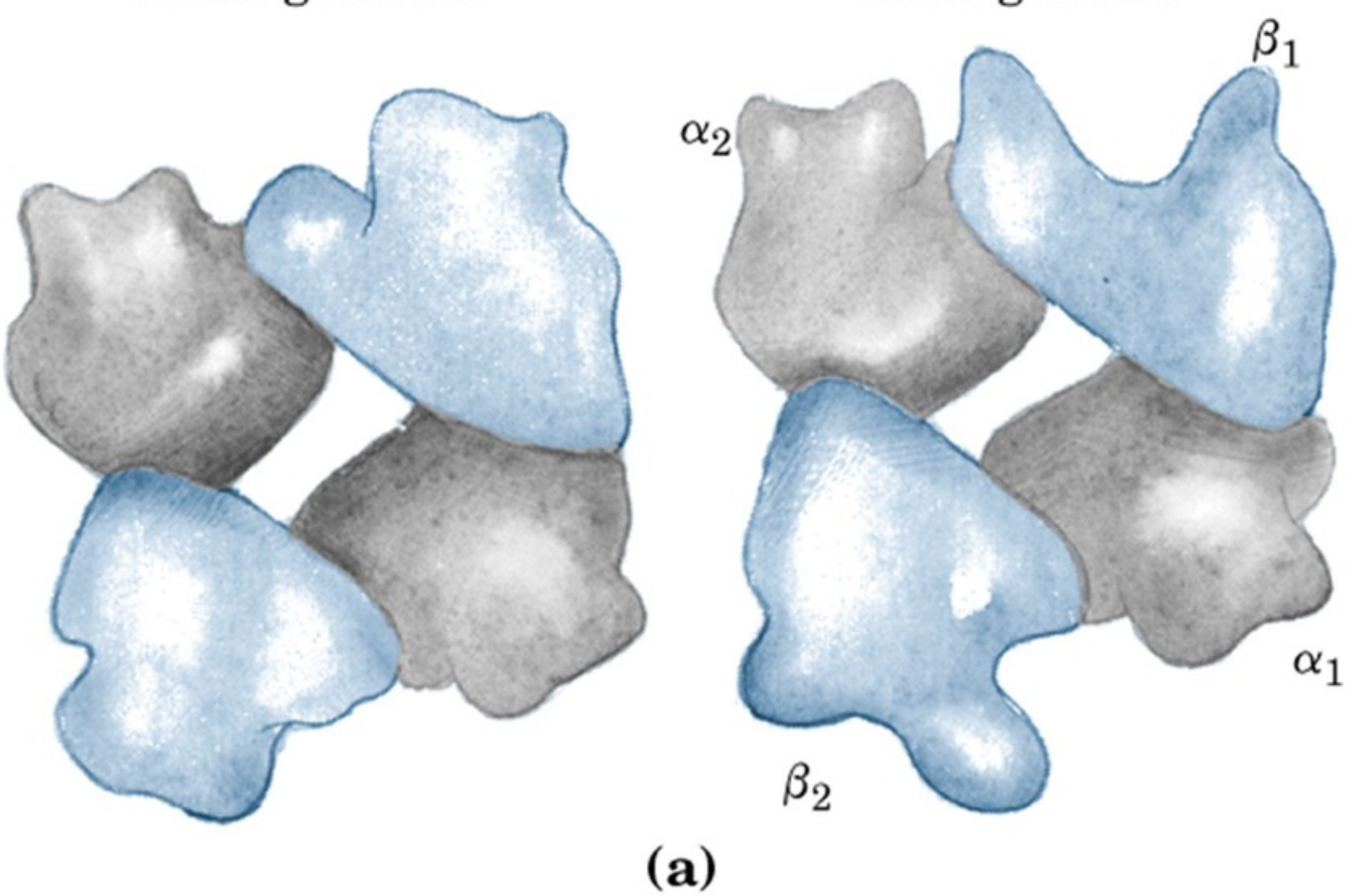
"Structure and function are really information processing being implemented by the physical and chemical properties made available by biological molecules, cells, networks of cells and so forth (...)."

Read Montague –
"Your brain is (almost) perfect – how we make decisions"

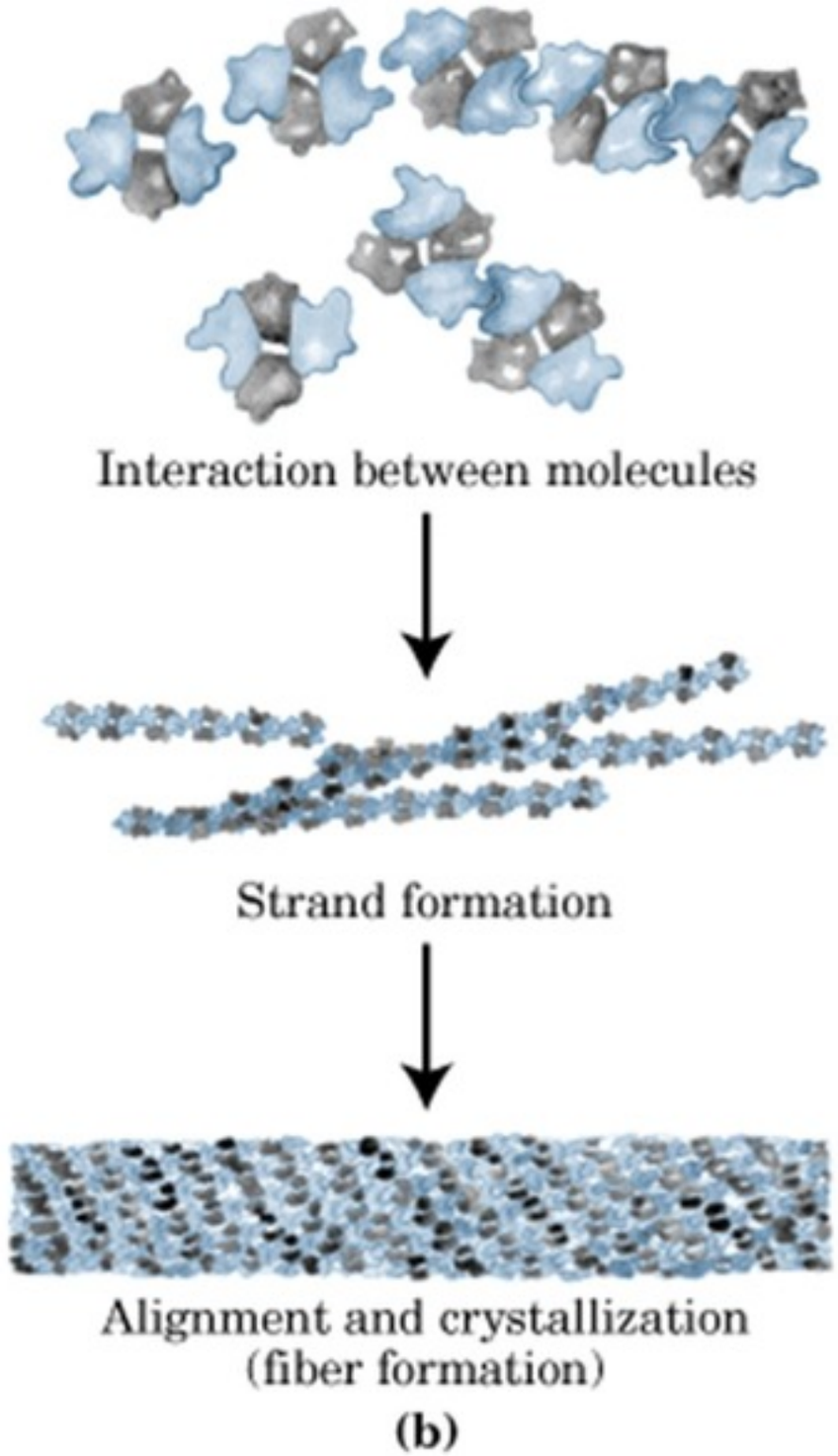
Figure 7-23
Biochemistry, Sixth Edition

Hemoglobina





(a)


Interaction between molecules
Strand formation
Alignment and crystallization
(fiber formation)

(b)

Figure 7-24
Biochemistry, Sixth Edition

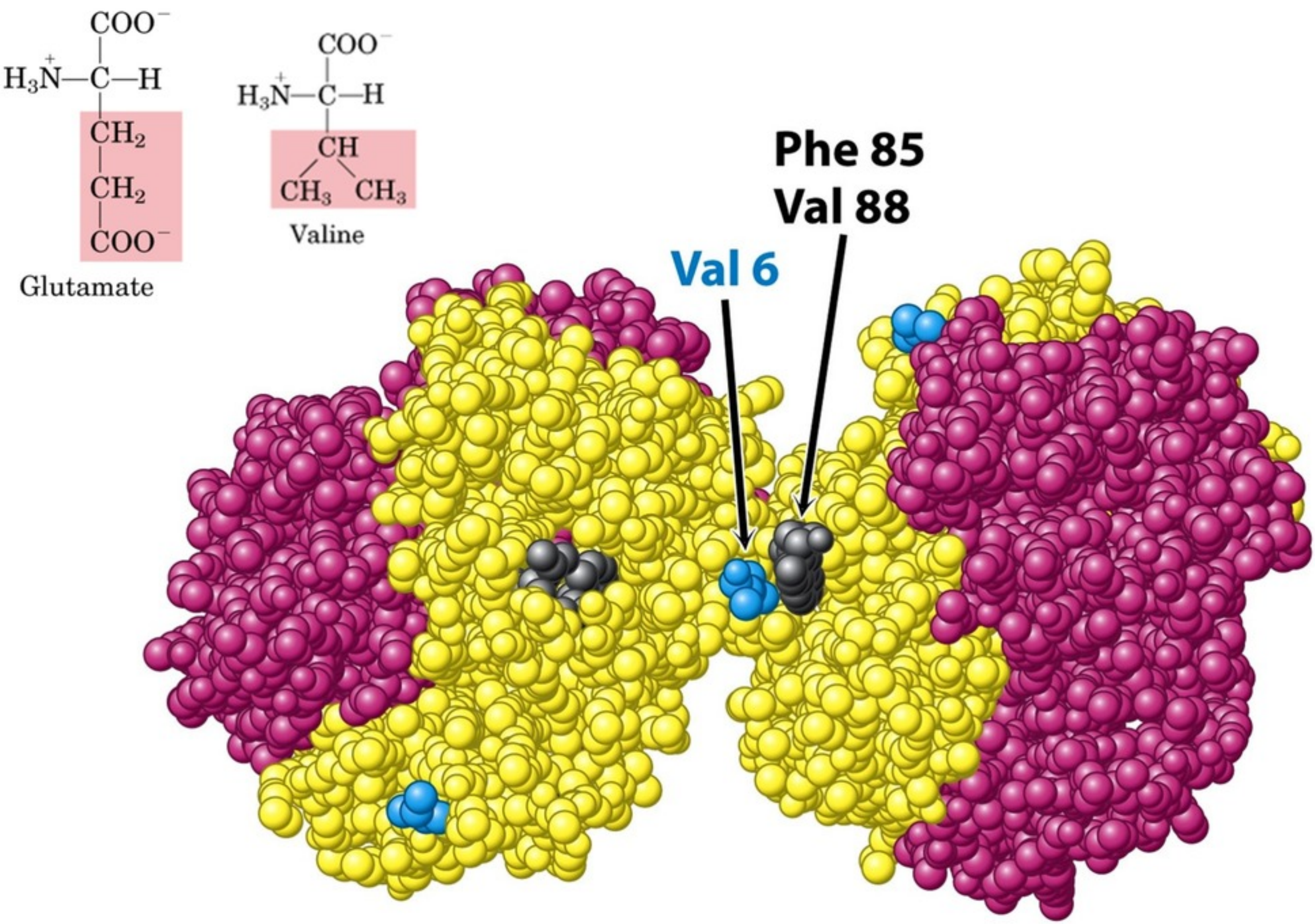


Figure 7-25
Biochemistry, Sixth Edition

Hb-S: substituição de glutamato por valina na posição 6 da cadeia β

Como a substituição da glutamina pela valina está relacionada com os efeitos fisiológicos observados na anemia falciforme?

Collaborate!

Hemoglobina S

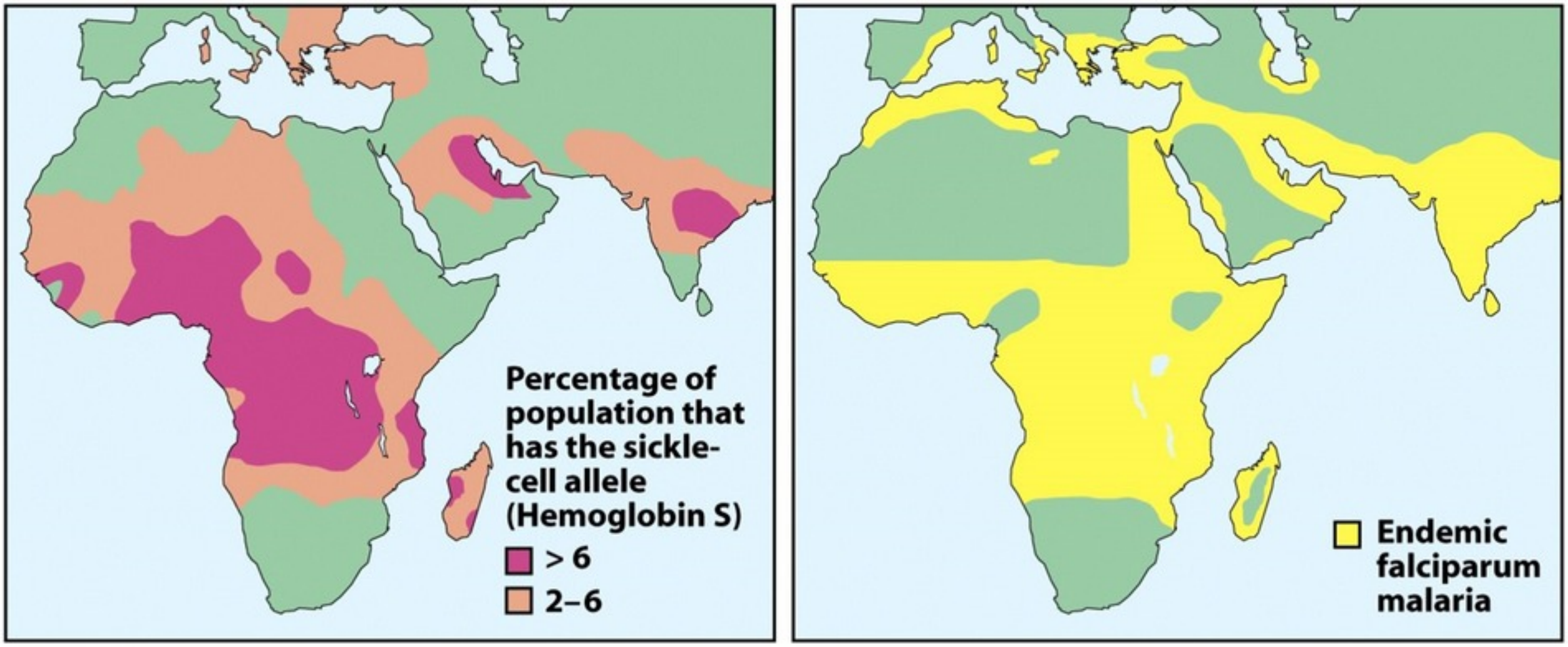


Figure 7-26
Biochemistry, Sixth Edition

ESTRUTURA e FUNÇÃO

Ligação reversível de outra molécula = LIGANTE

Sítio de ligação

Especificidade

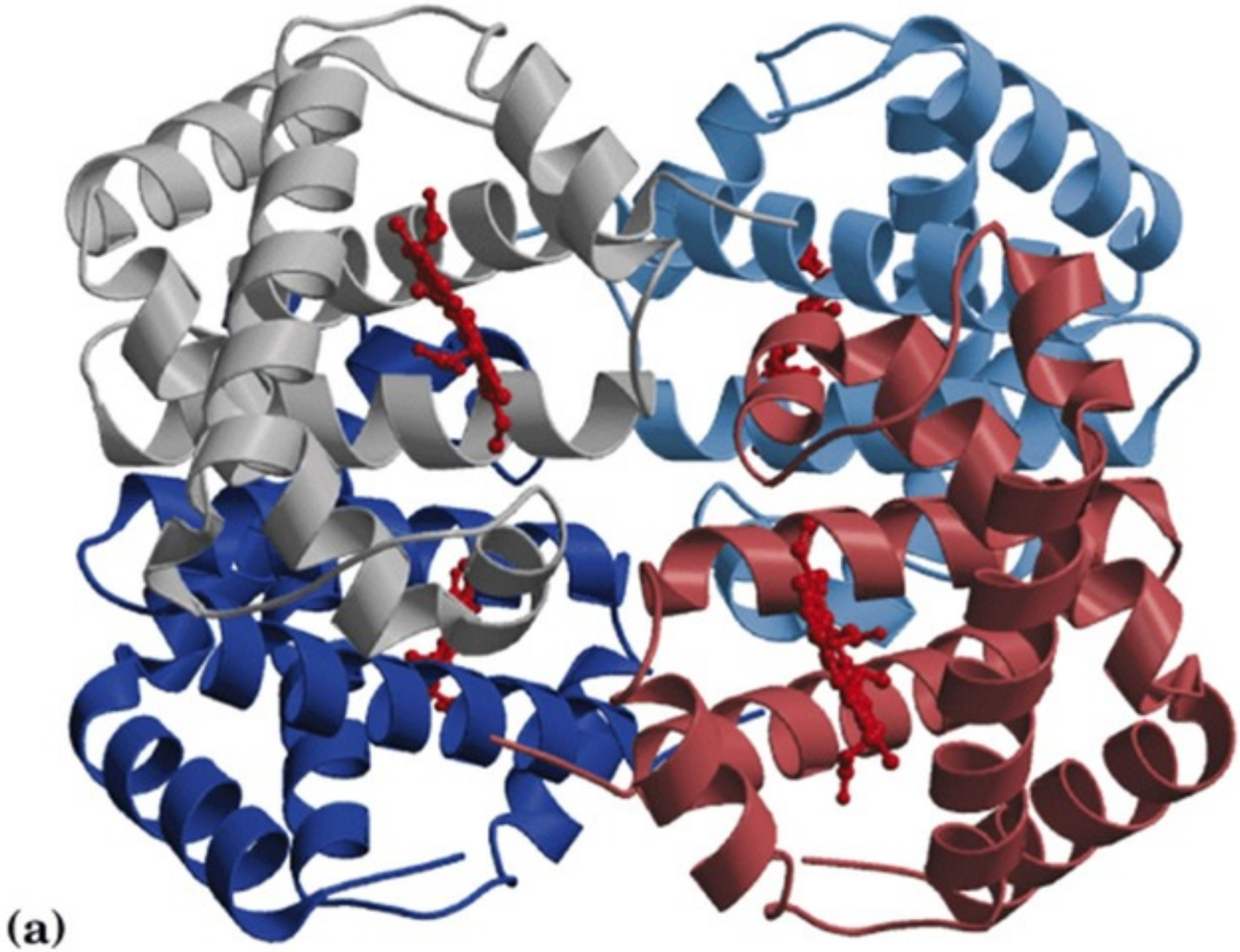
Conformação

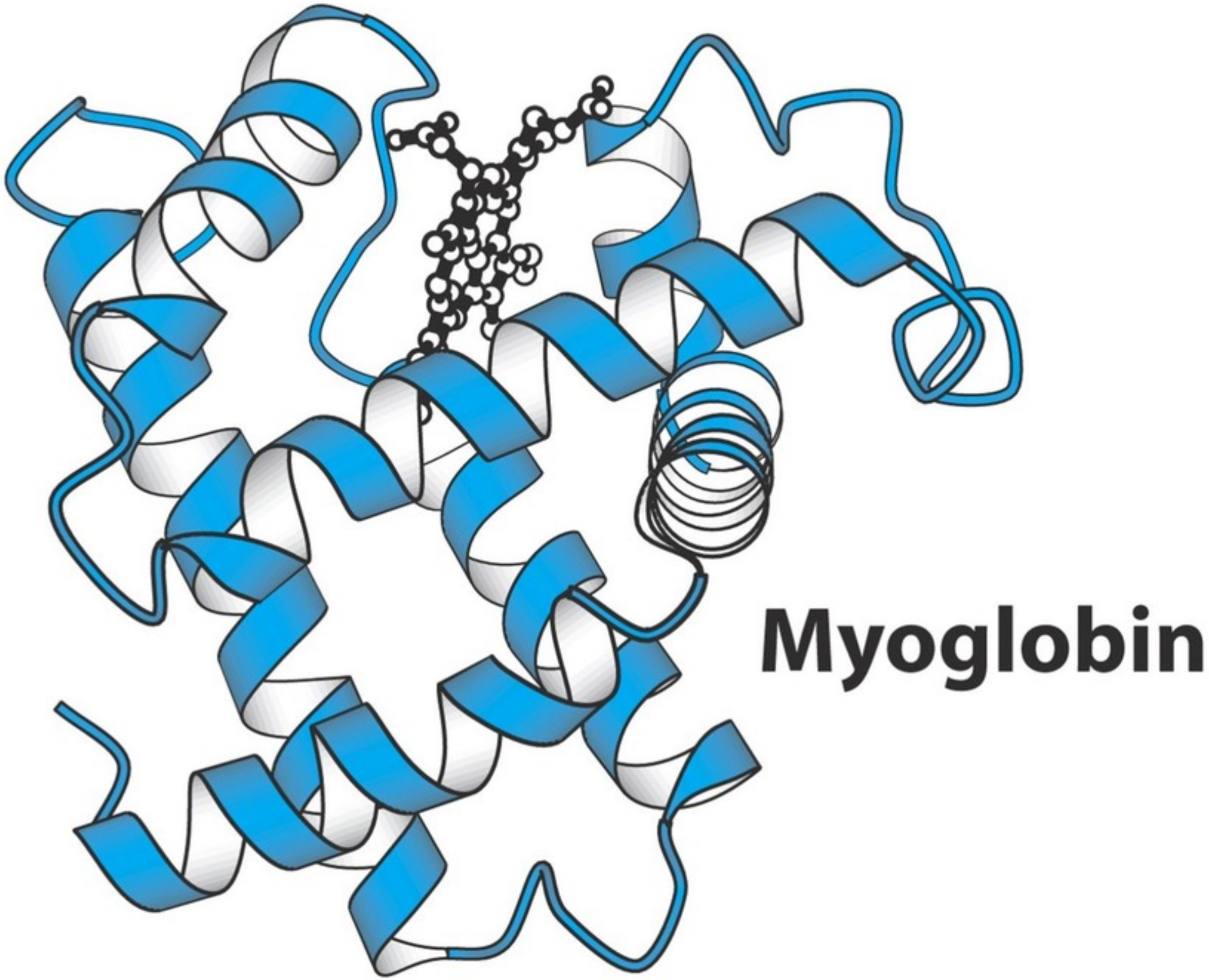
Flexibilidade

Alterações estruturais

Regulação da interação entre ligantes e proteínas

Hemoglobina





Myoglobin

Figure 7-1
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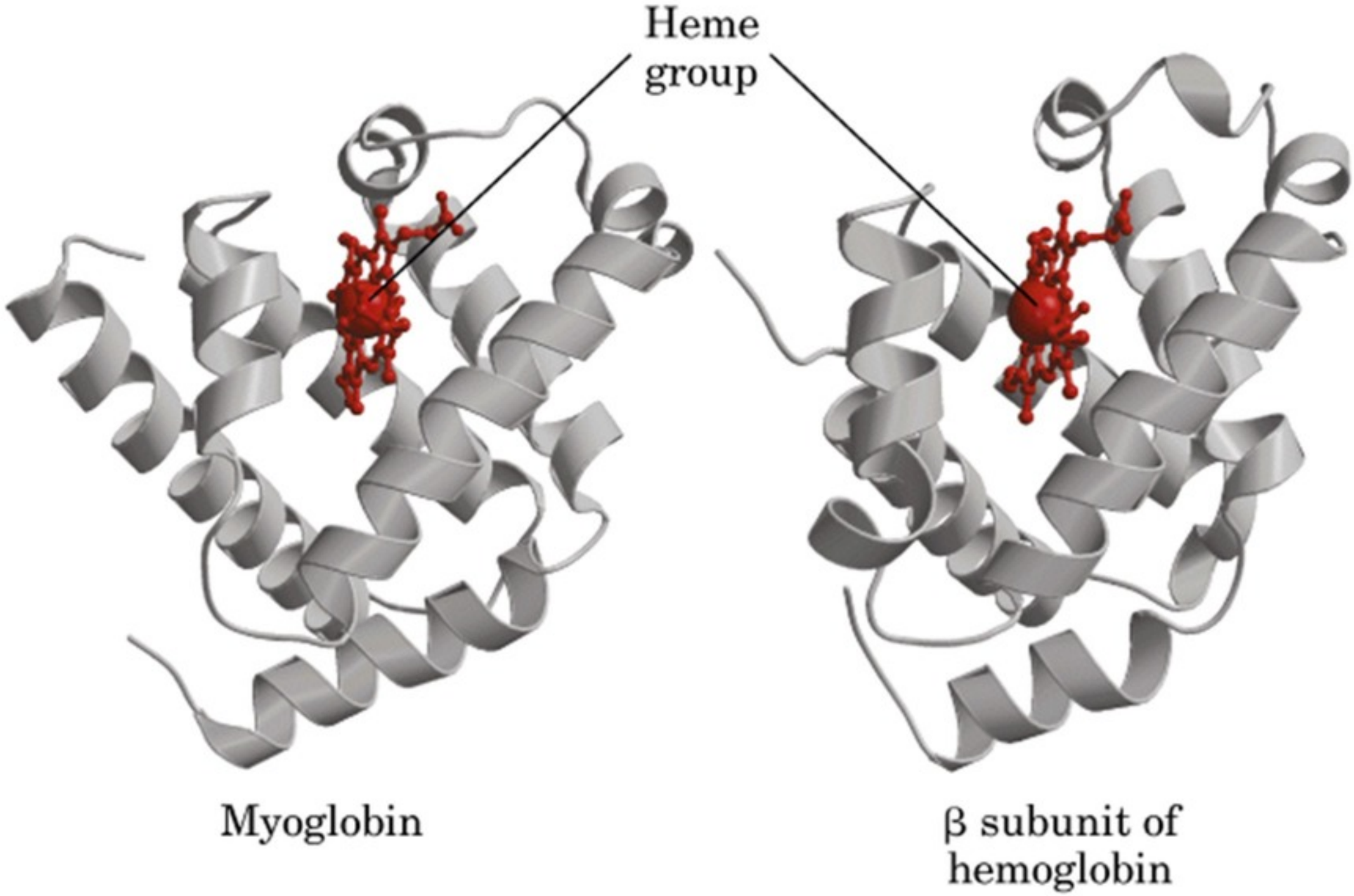
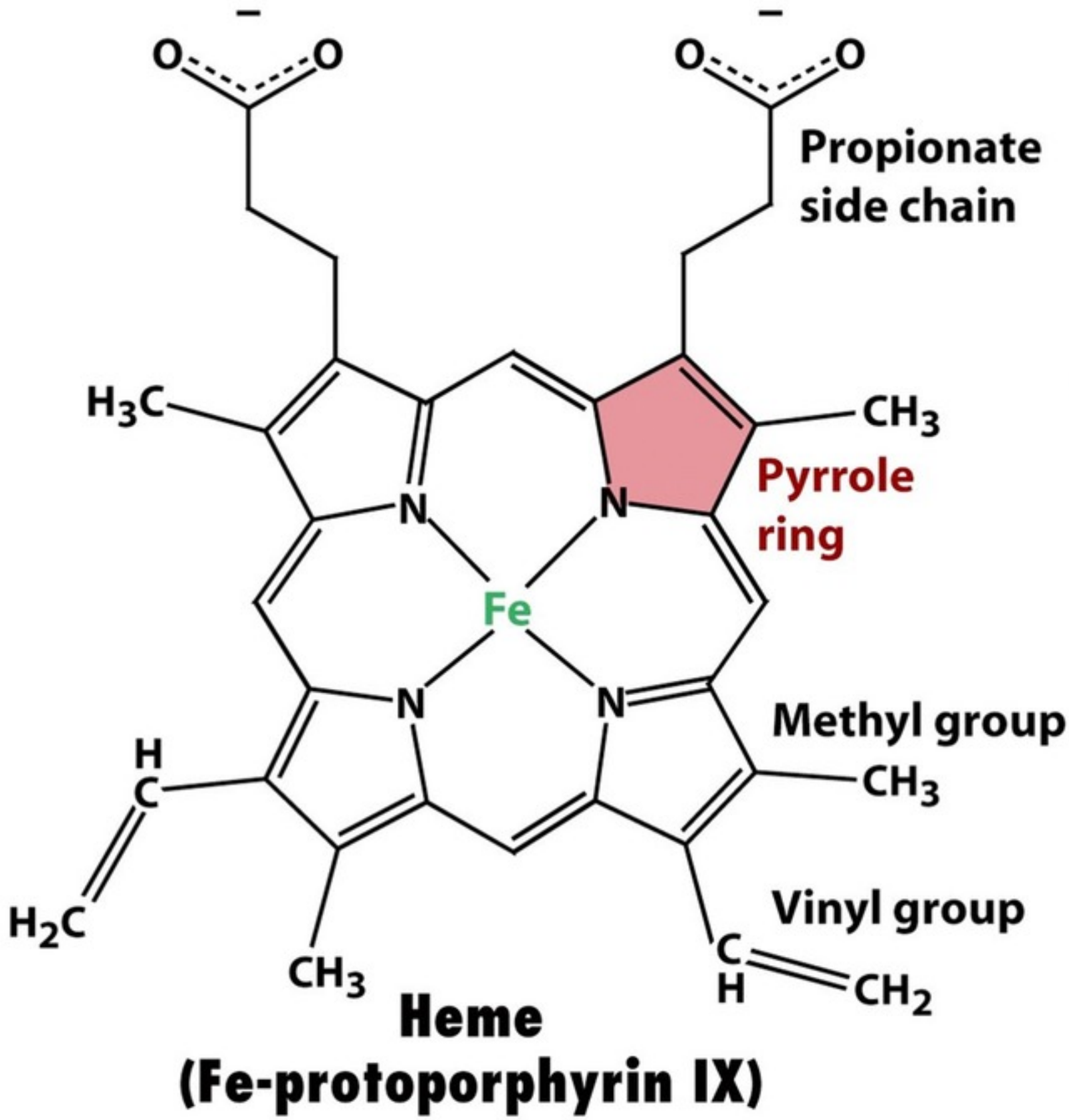
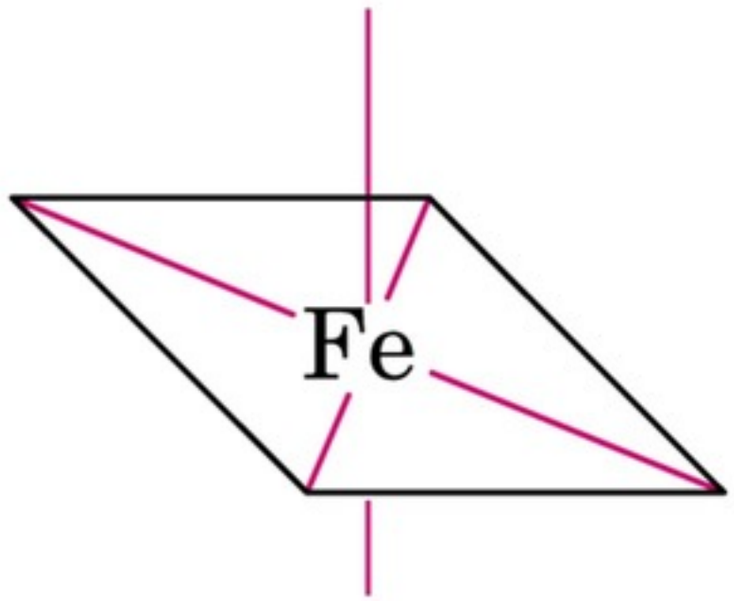
Grupo prostético







Unnumbered figure pg 184
Biochemistry, Sixth Edition

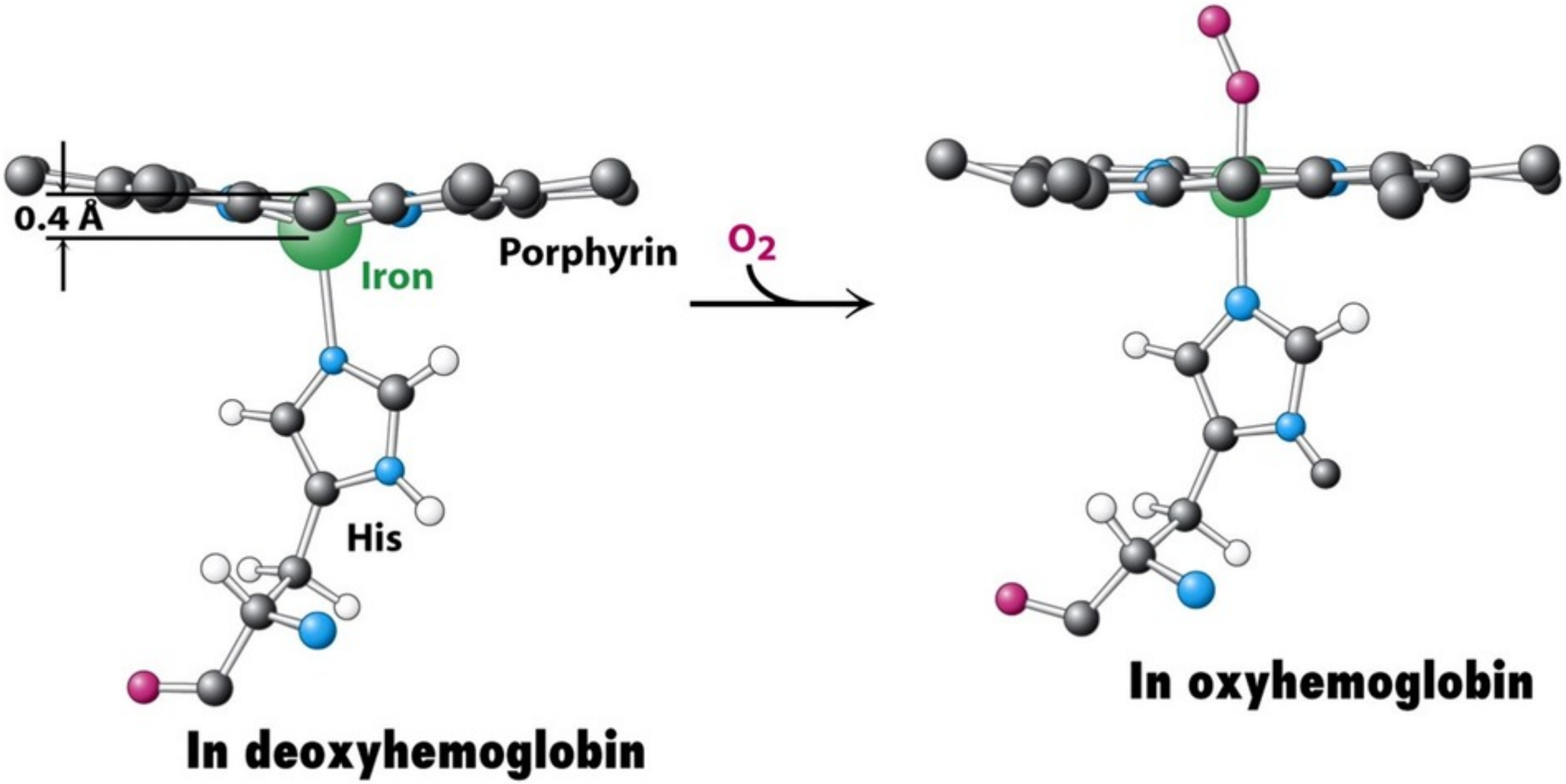


Figure 7-2
Biochemistry, Sixth Edition

Poll

A mioglobina se liga a X oxigênios e a hemoglobina a Y. X =? e Y=?

- 1 e 2
- 2 e 4
- 1 e 1
- 1 e 4

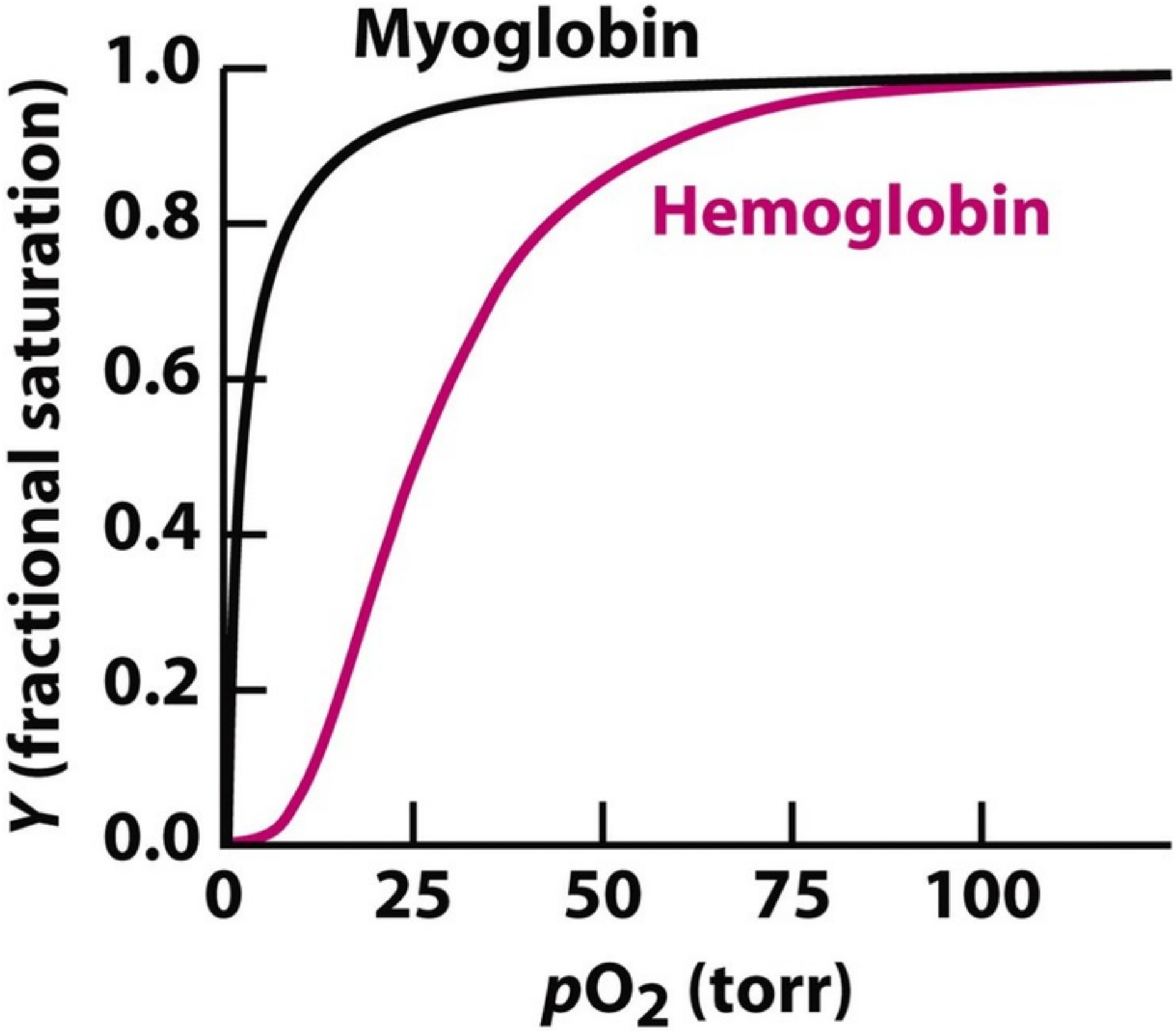
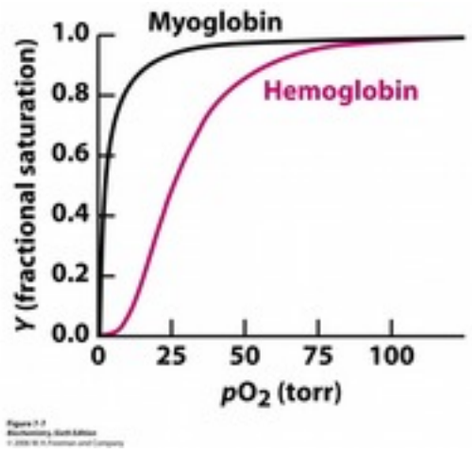


Figure 7-7
Biochemistry, Sixth Edition

Poll



Qual das proteínas tem maior afinidade pelo oxigênio?

- Mioglobina
- Hemoglobina

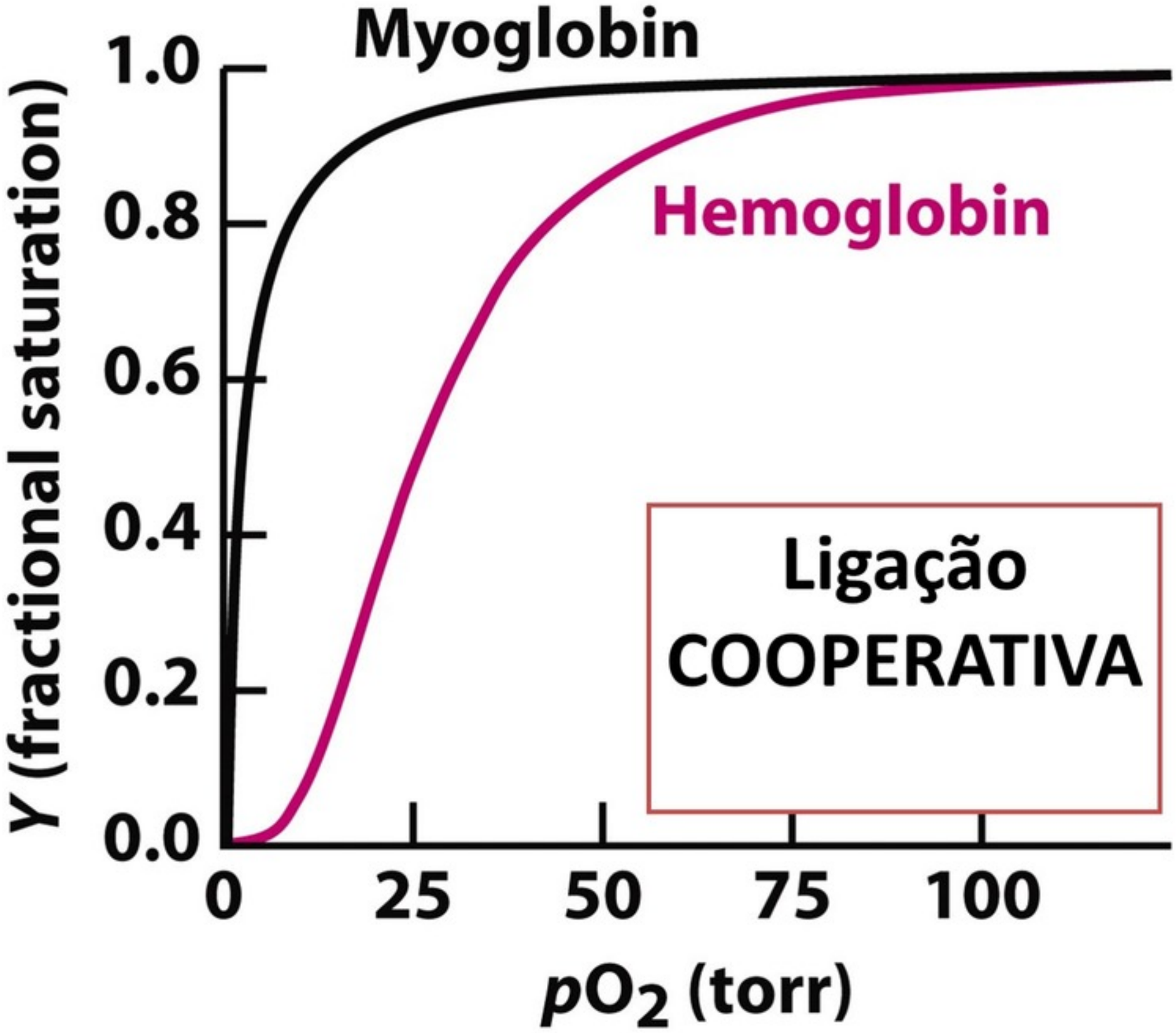
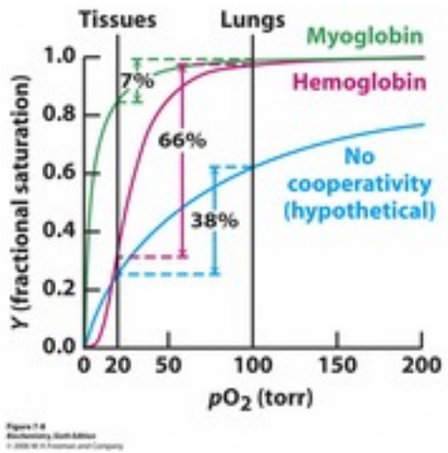


Figure 7-7
Biochemistry, Sixth Edition

Poll



Qual das proteínas é um transportador mais eficiente de oxigênio?

mioglobina

hemoglobina

hemoglobina sem cooperatividade

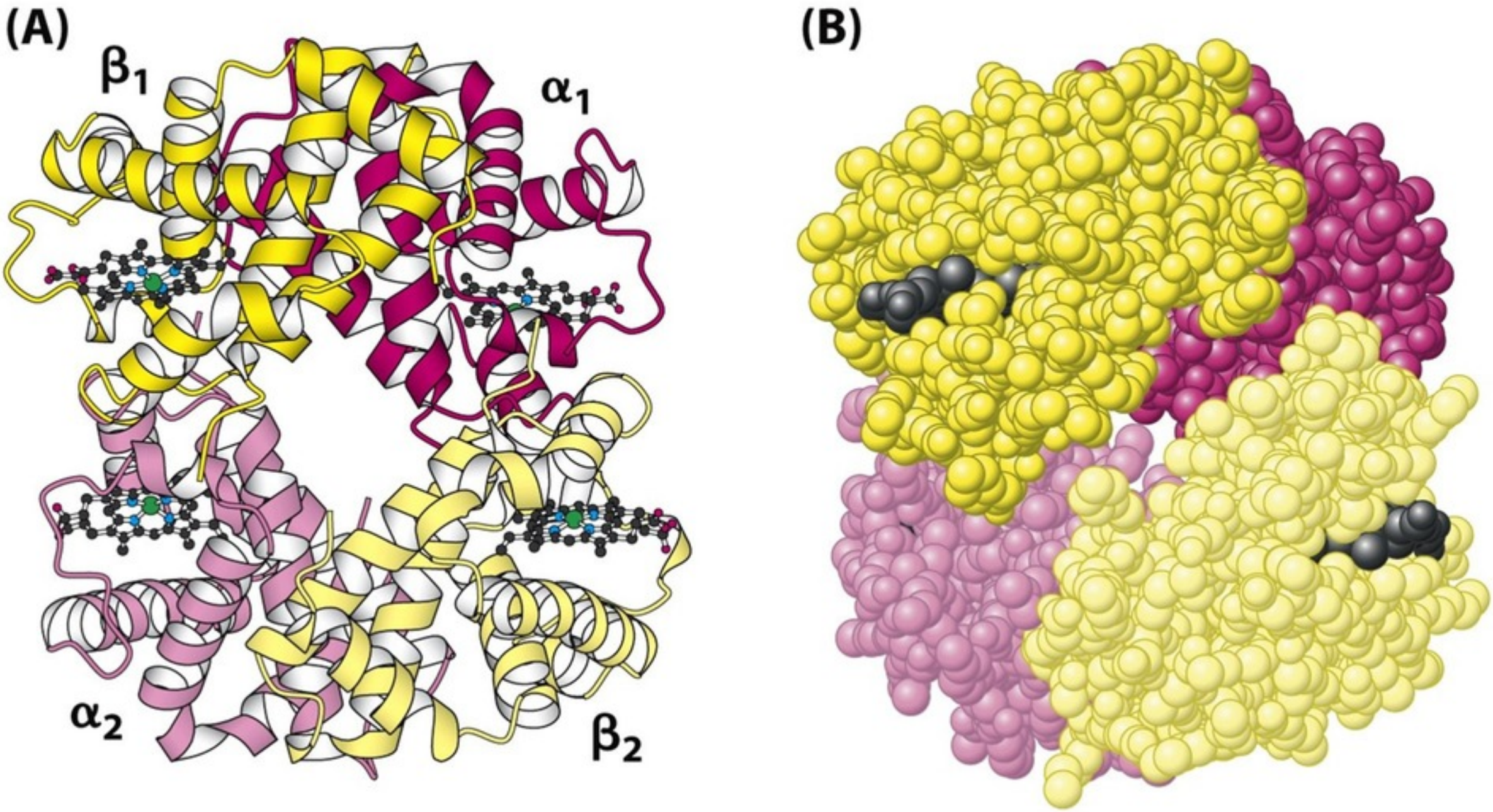


Figure 7-5
Biochemistry, Sixth Edition

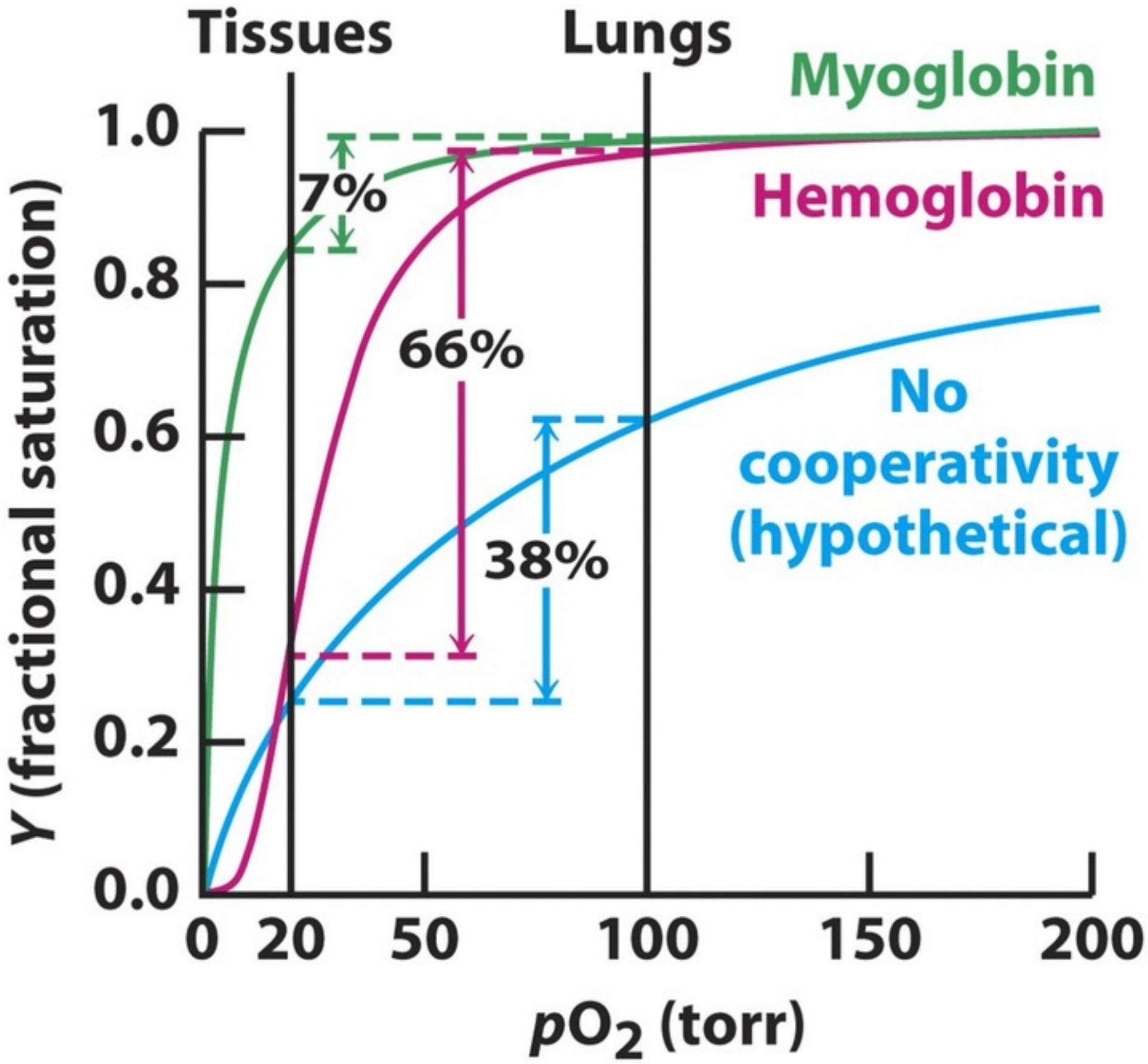


Figure 7-8
Biochemistry, Sixth Edition

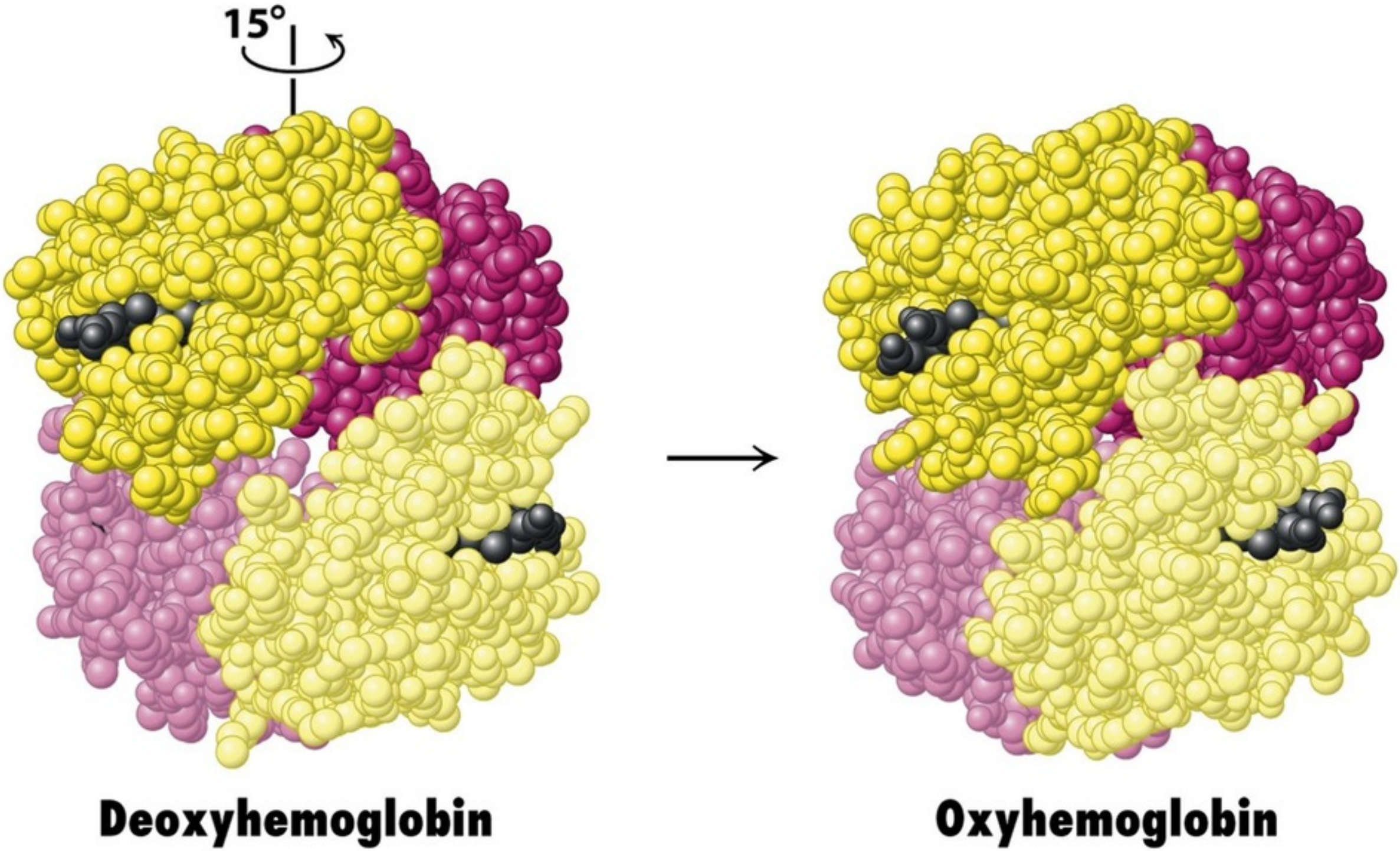


Figure 7-10
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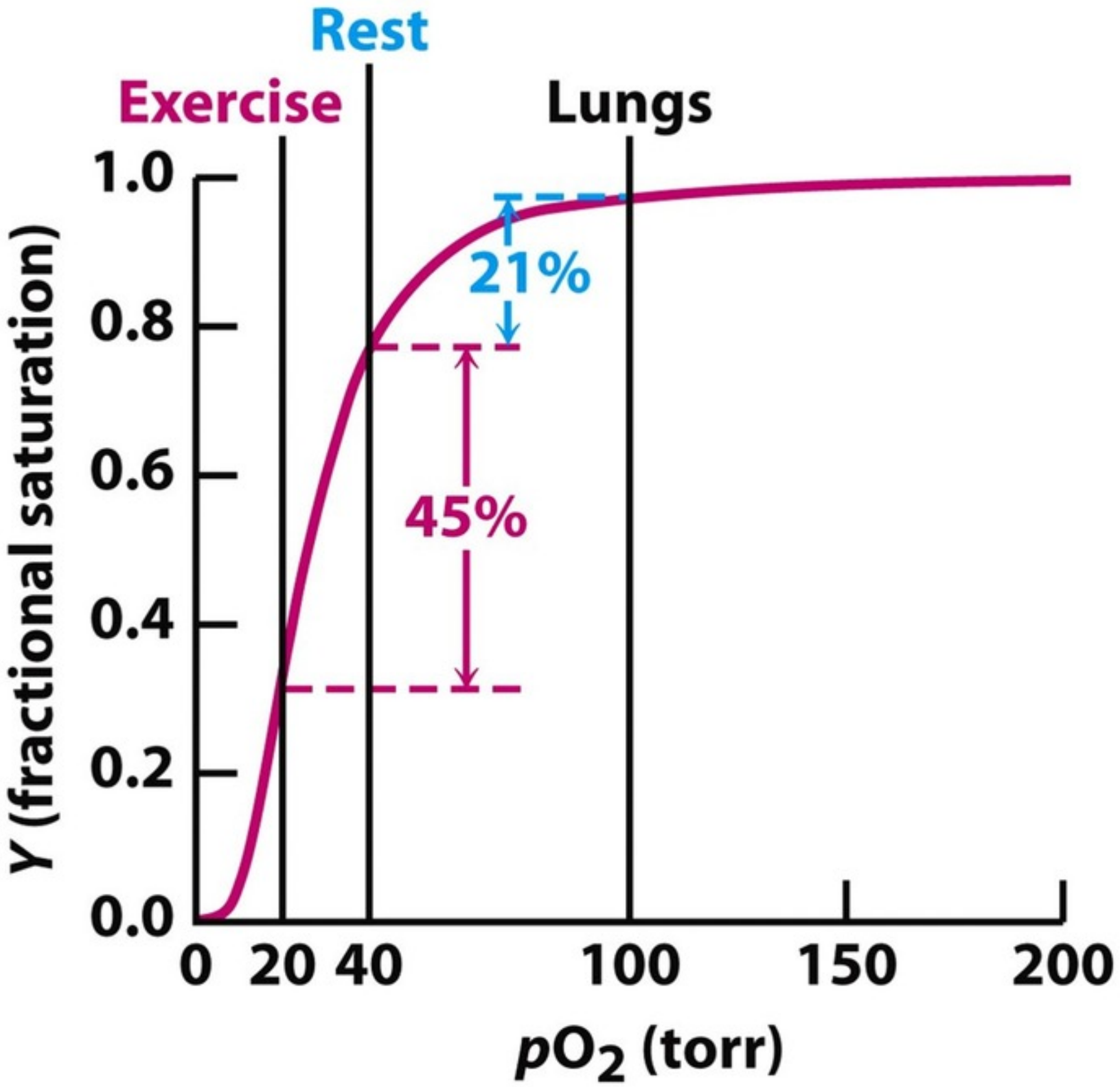

Figure 7-9
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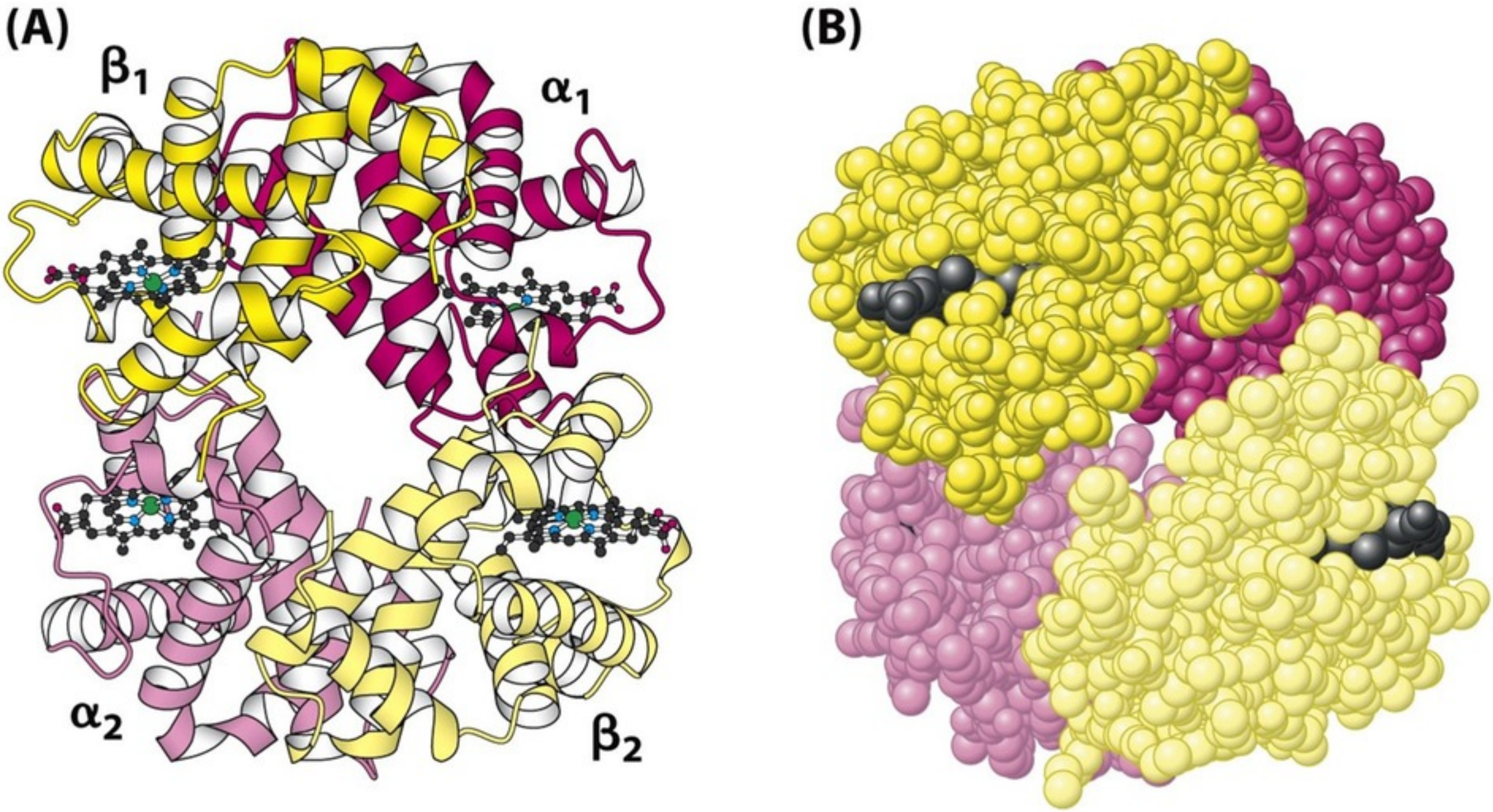
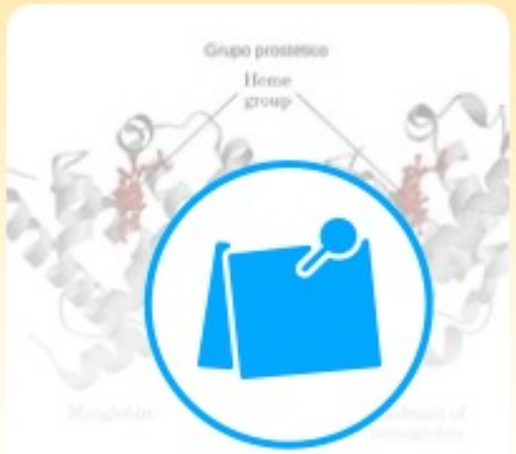


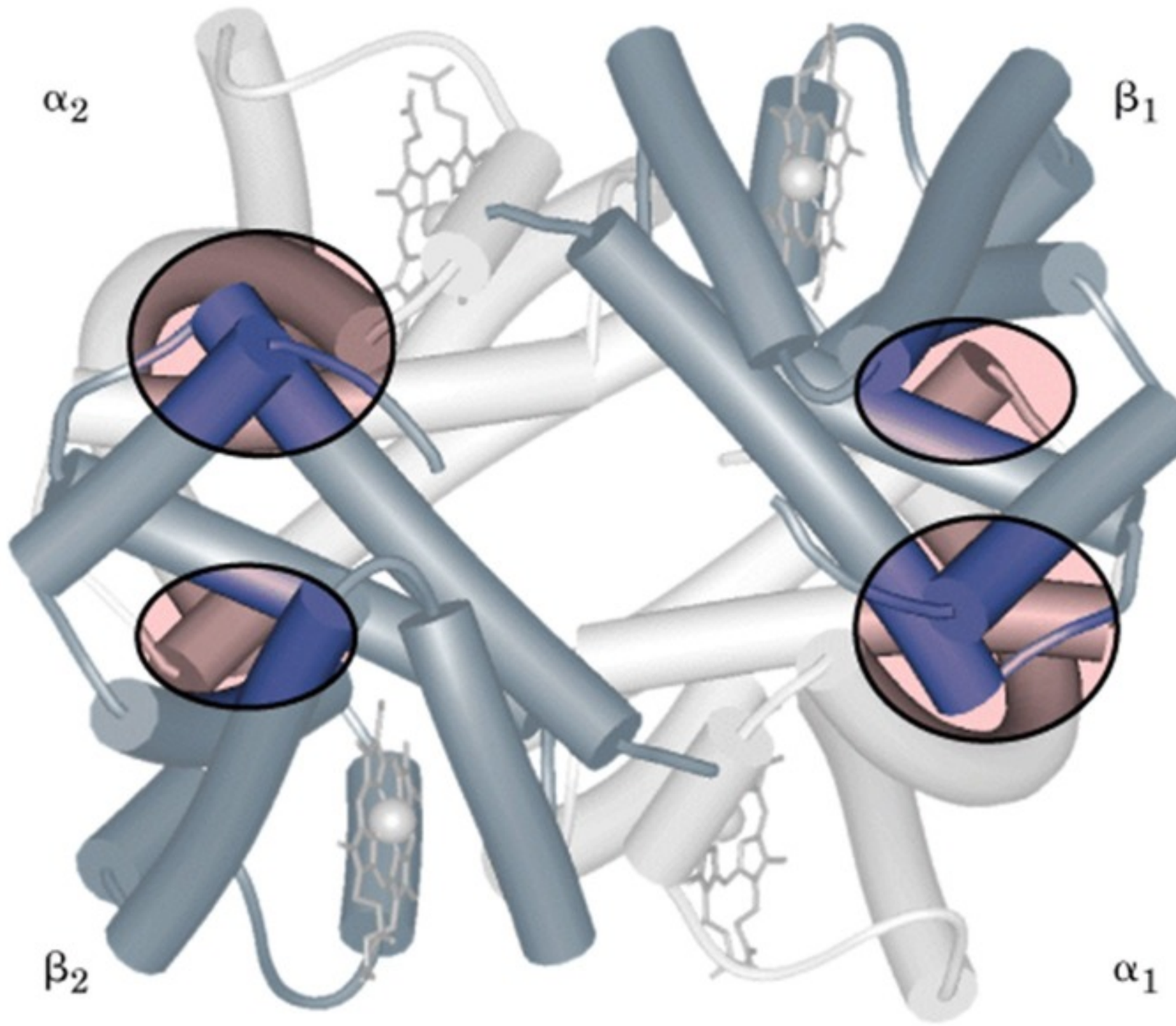
Figure 7-5
Biochemistry, Sixth Edition



Collaborate!

Mioglobina e hemoglobina

Interações α1 β1 e α2 β2

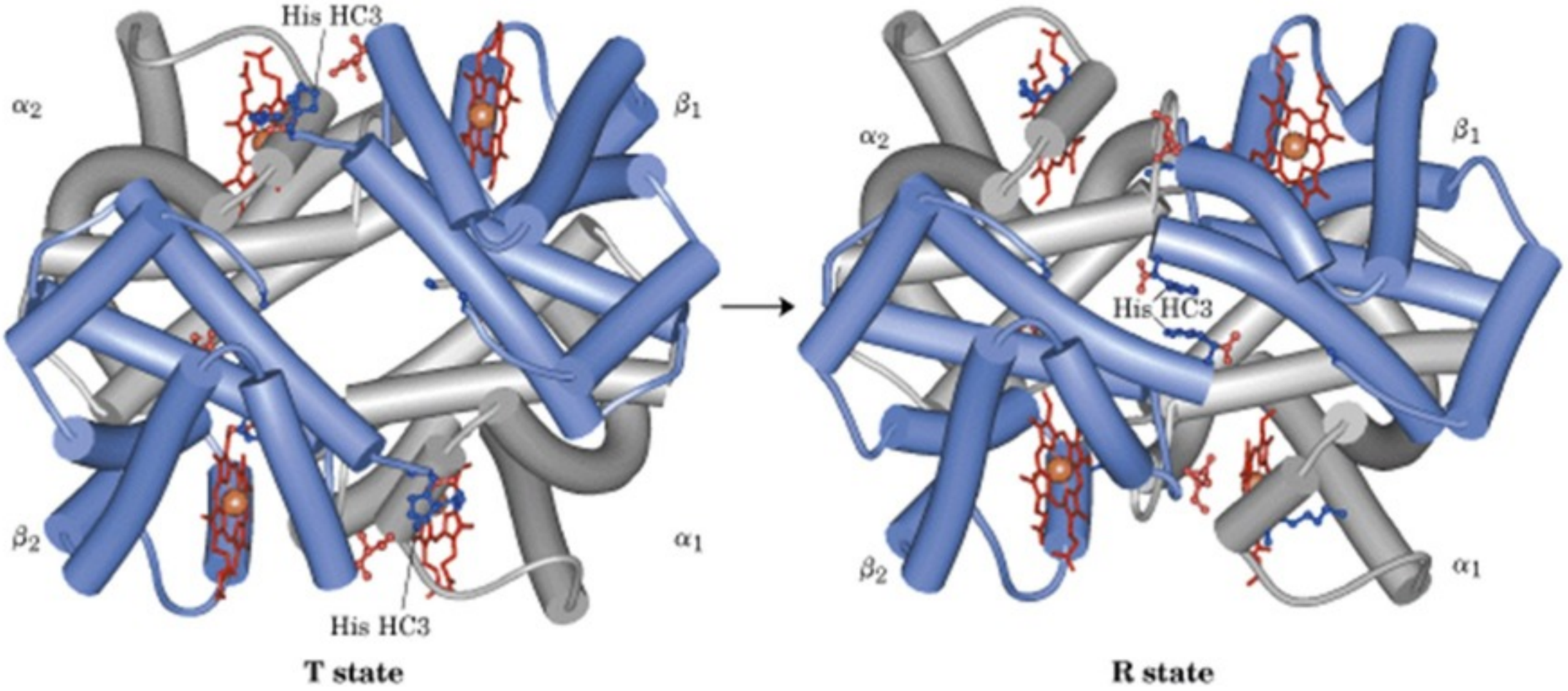


SEM O_2

desoxihemoglobina

COM O_2

oxihemoglobina



Tenso: estabilizado por mais ligações iônicas

Relaxado: pares iônicos que estabilizam estado T são rompidos, novos são formados

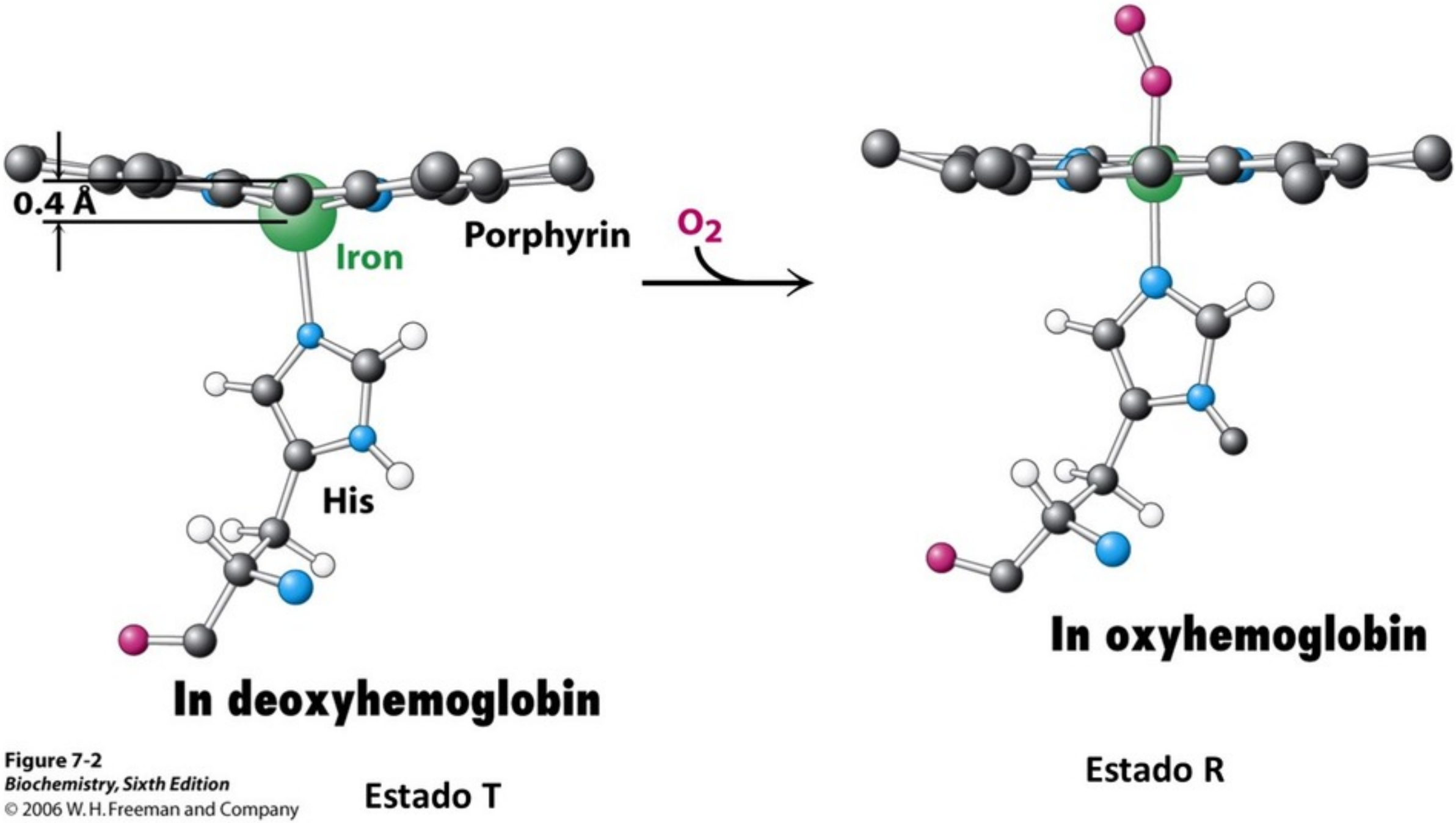
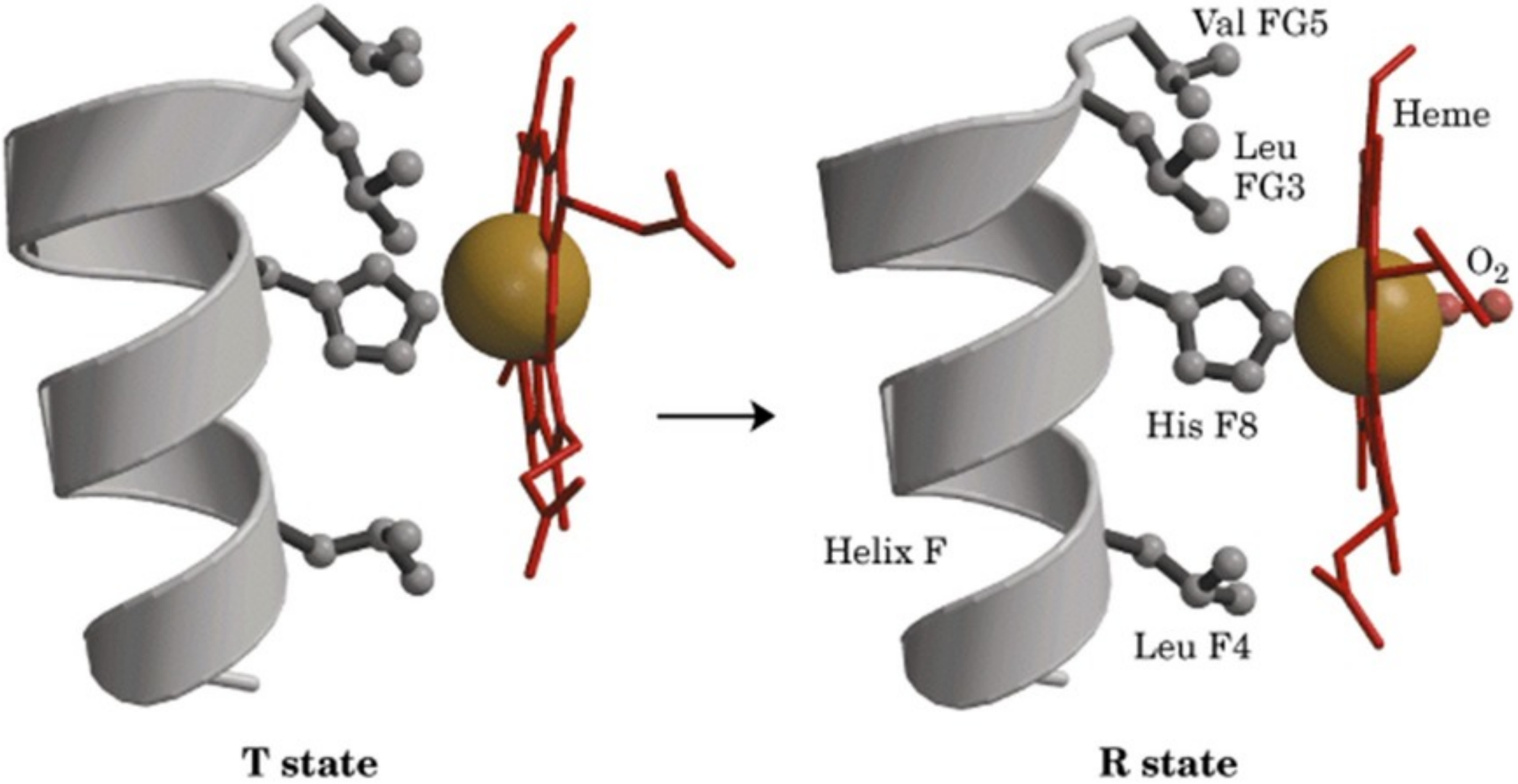
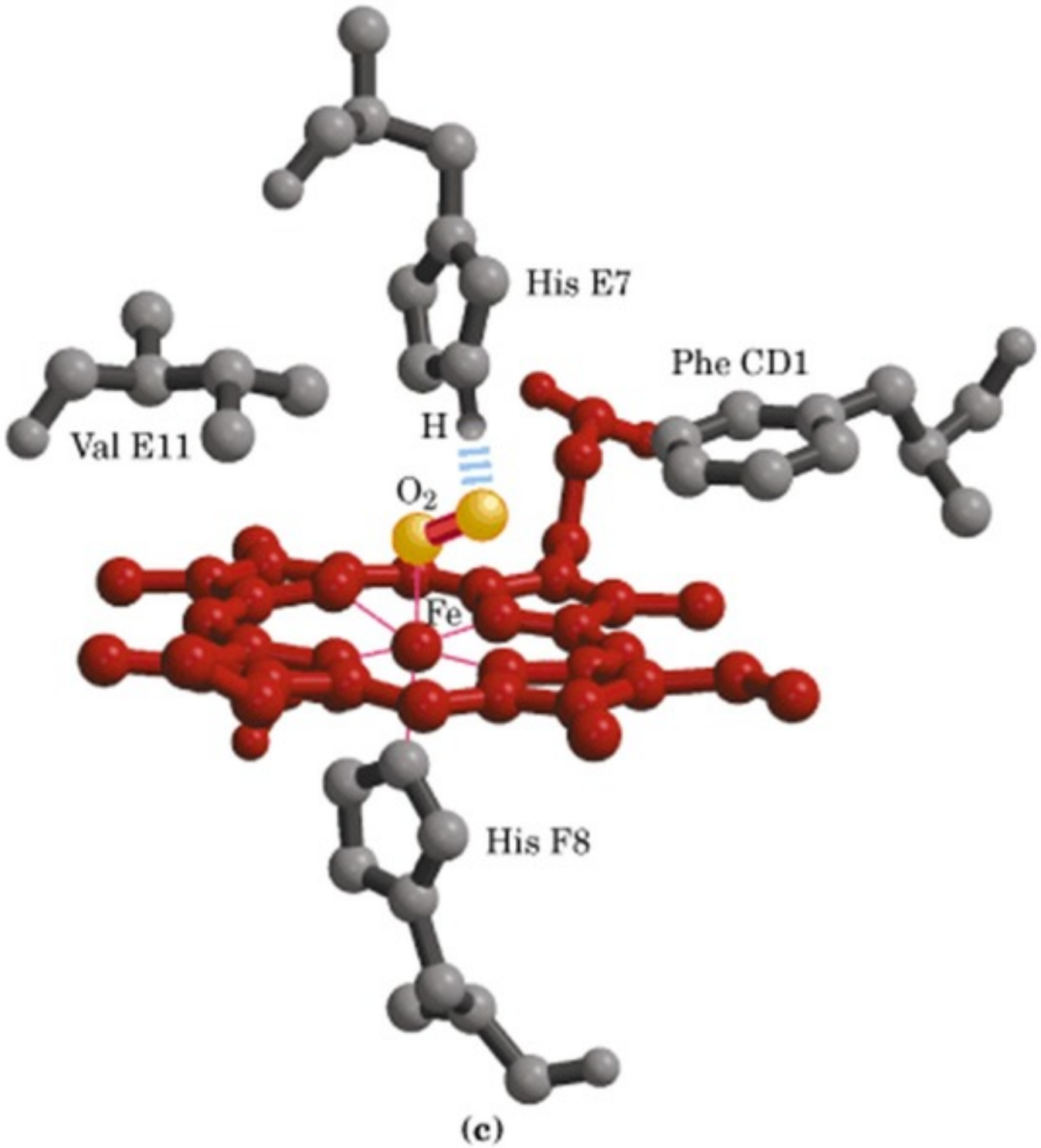


Figure 7-2
Biochemistry, Sixth Edition


Val FG5
Heme
Leu
FG3
O_2
His F8
Helix F
Leu F4
T state
R state



(c)

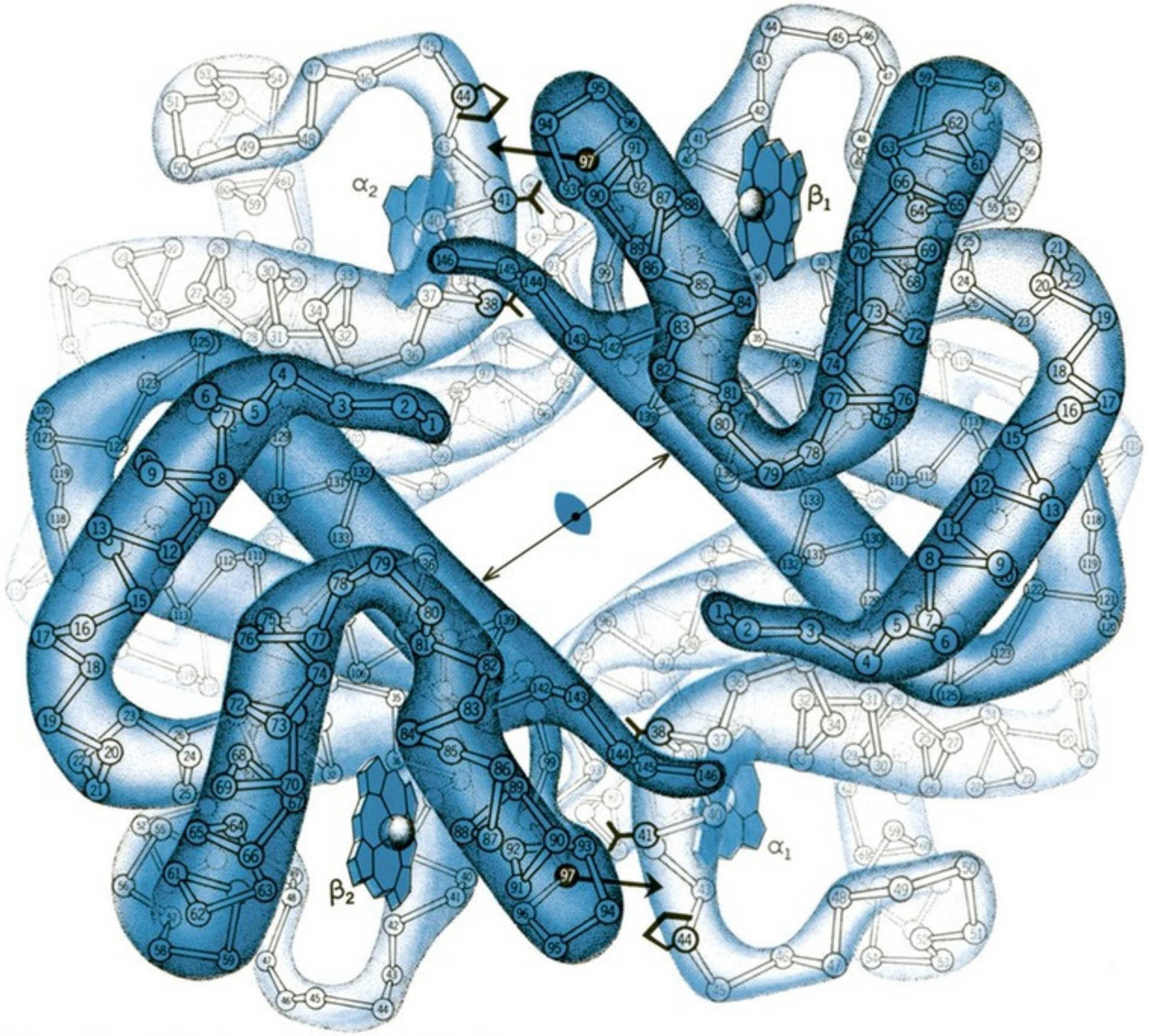


Figure 7-5 part 1 Fundamentals of Biochemistry, 2/e

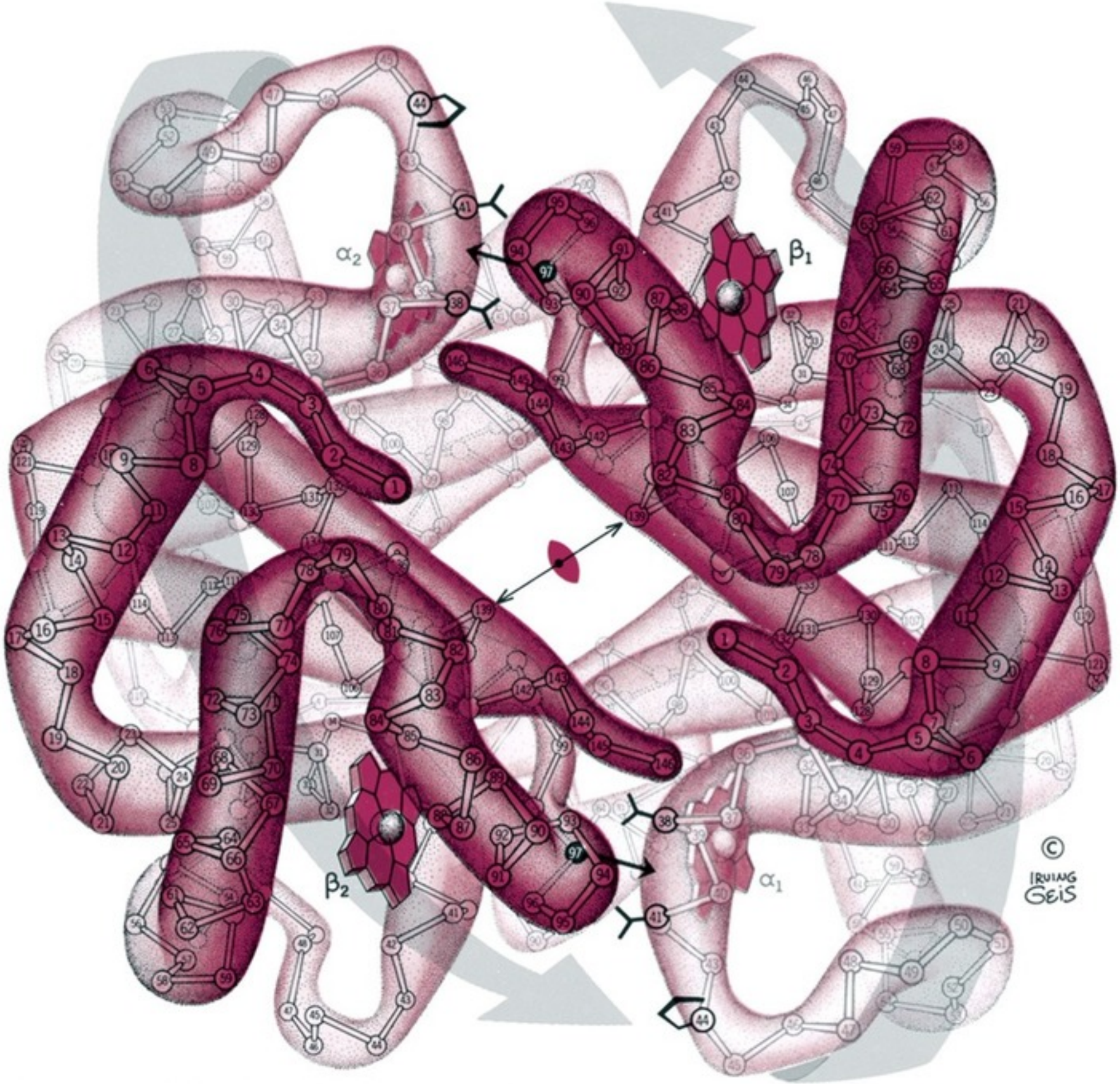
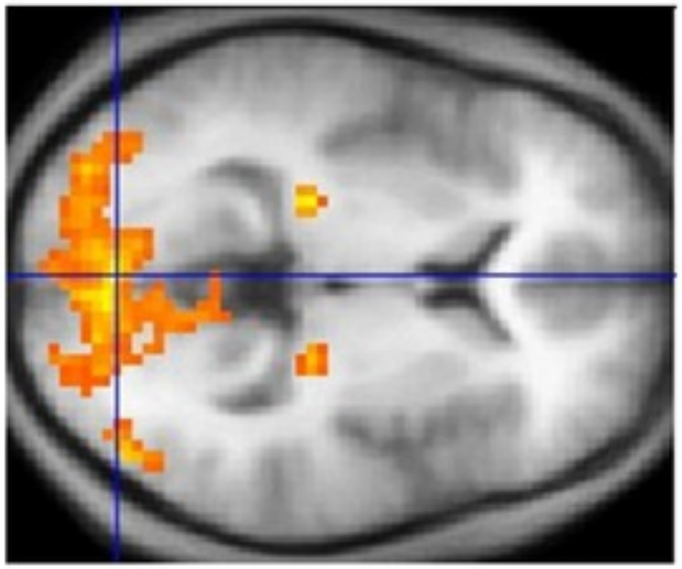
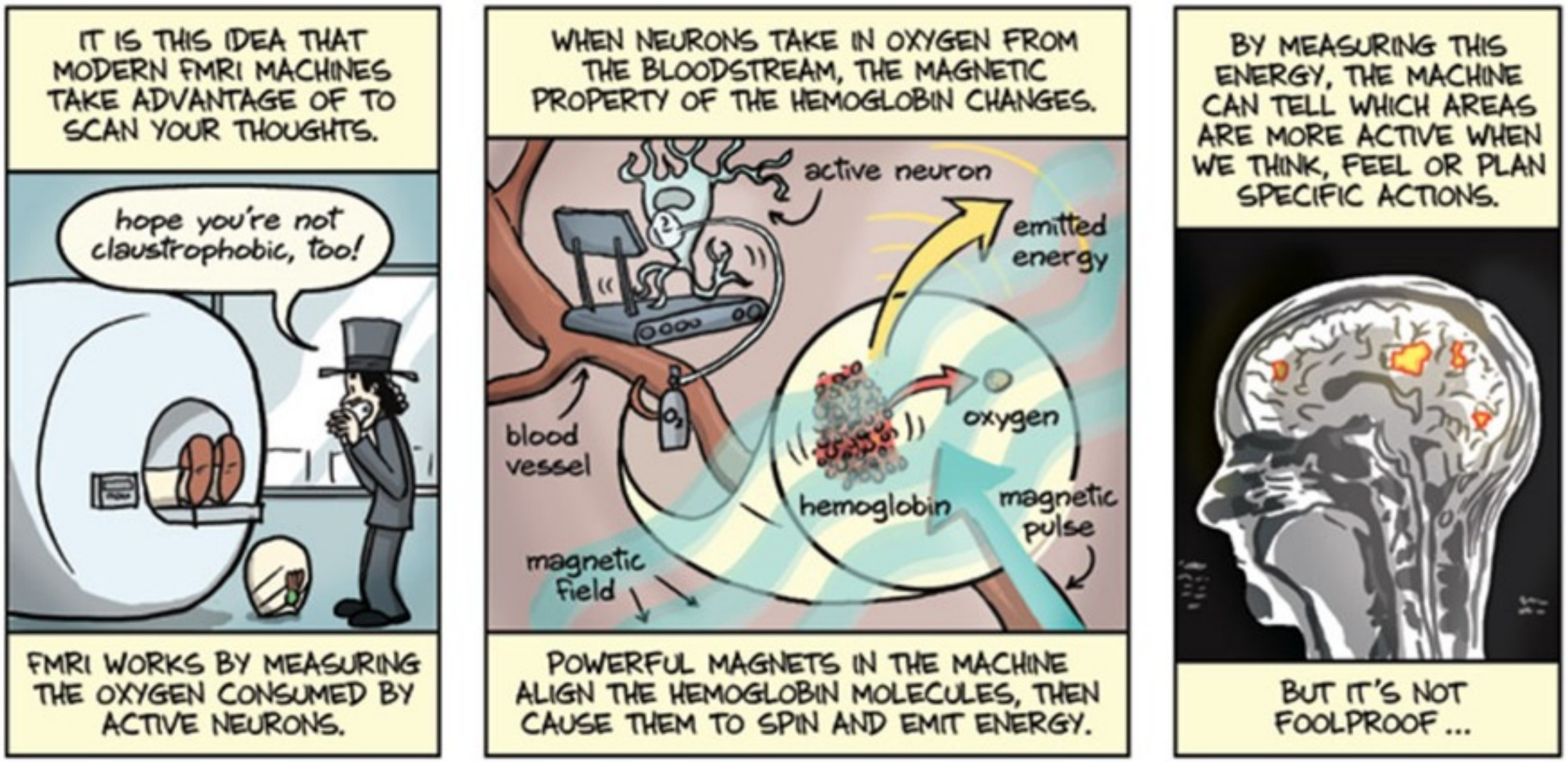


Figure 7-5 part 2 Fundamentals of Biochemistry, 2/e



Scientific american mind, mar 2011



Proteína alostérica:

Ligante em um sítio afeta as propriedades de ligação de outro sítio

(allos = outra, stereos = estrutura)

Ligação cooperativa de oxigênio na hemoglobina:
Ligação alostérica

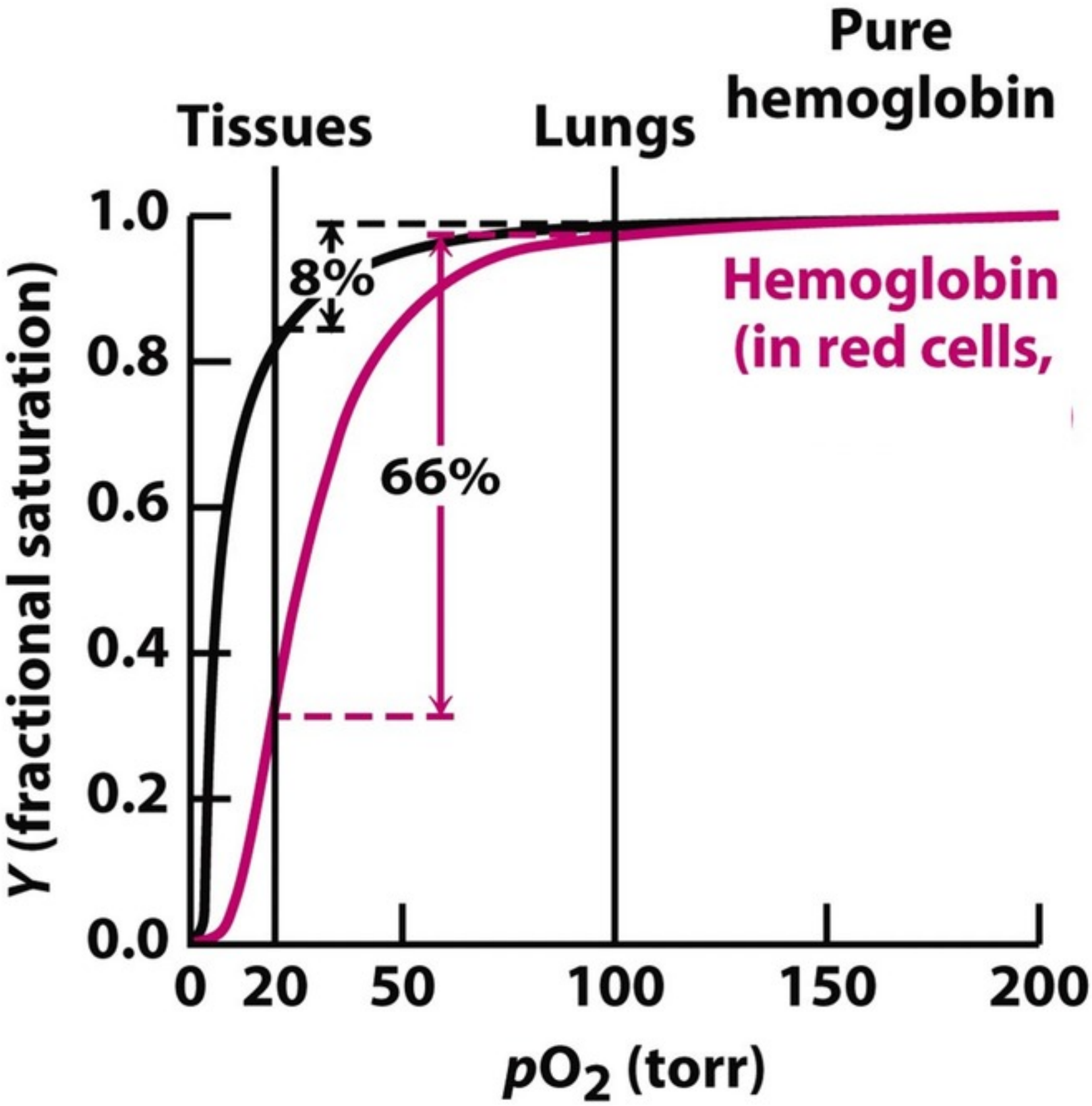
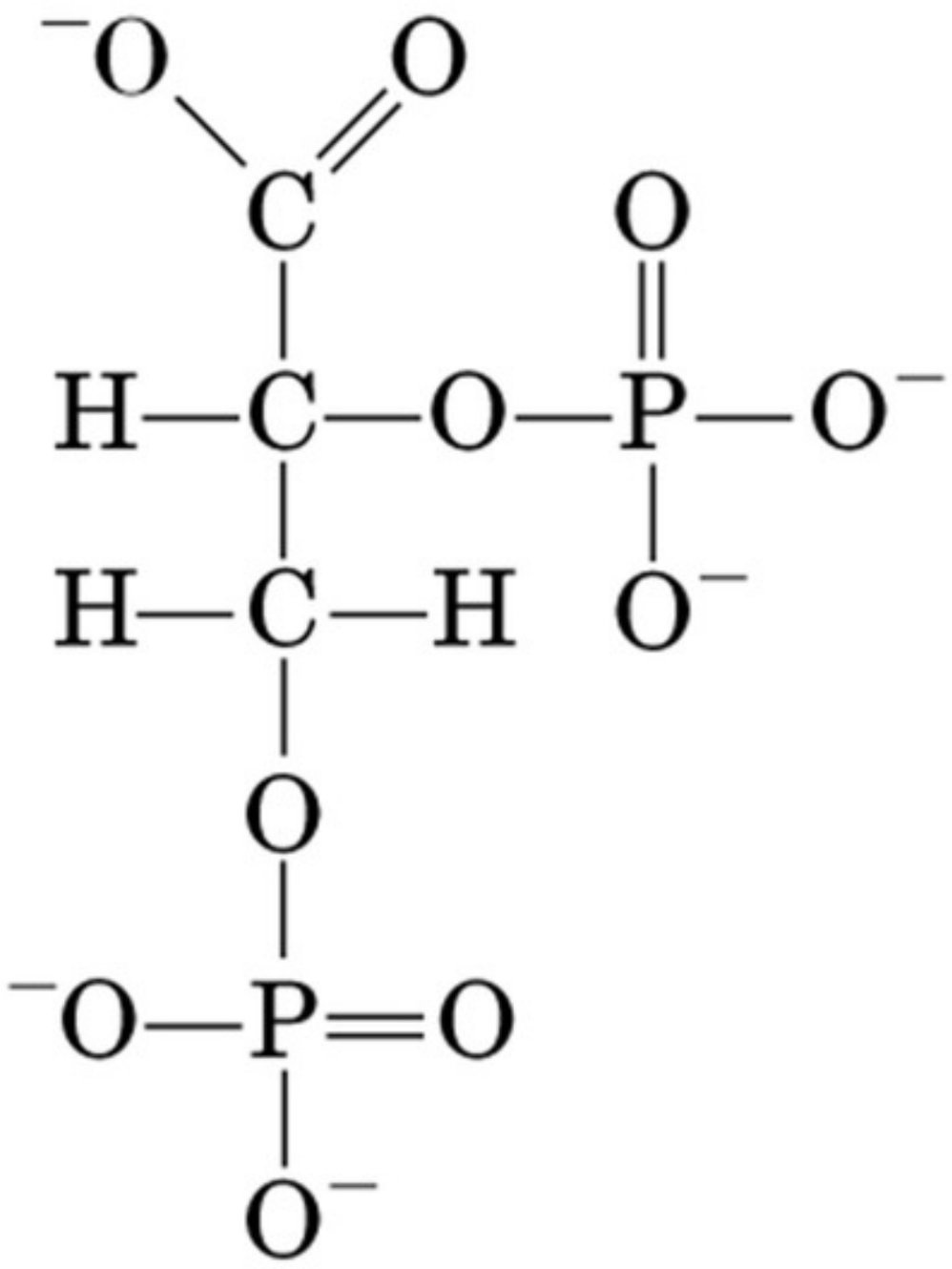


Figure 7-15
Biochemistry, Sixth Edition



2,3-Bisphosphoglycerate

2,3 BPG: Efetuador alostérico

(allos = outra, stereos = estrutura)

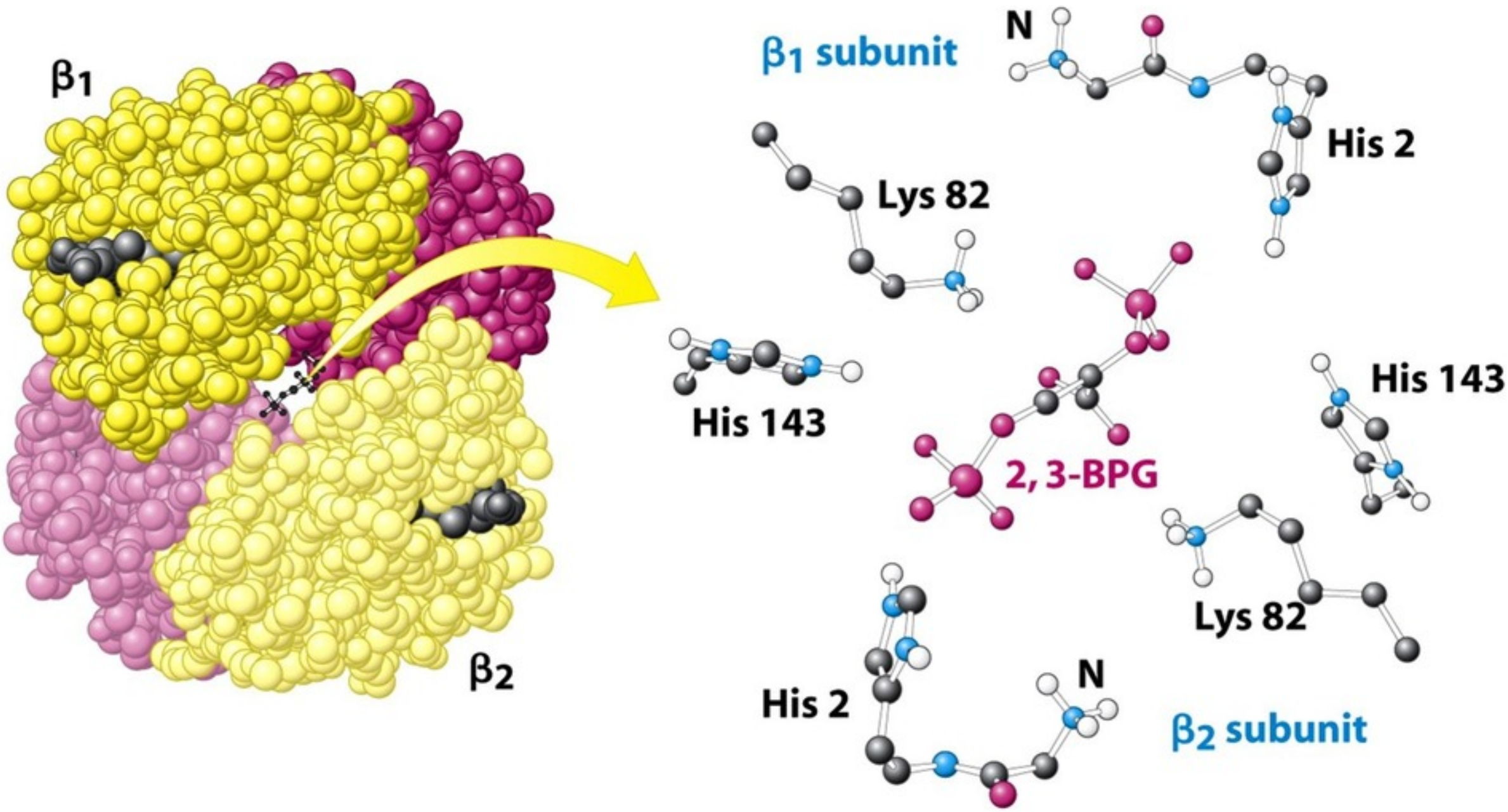


Figure 7-16
Biochemistry, Sixth Edition

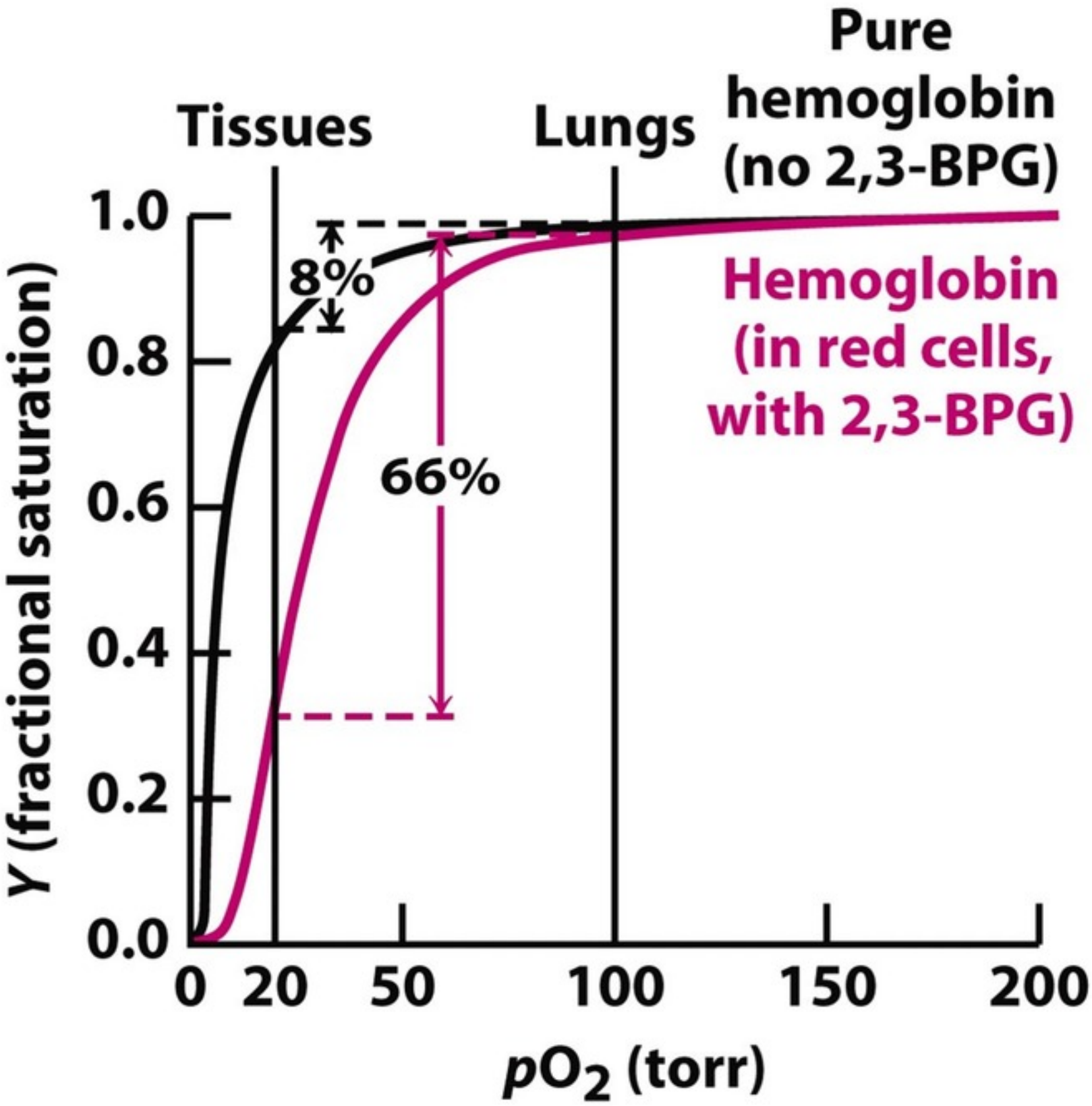


Figure 7-15
Biochemistry, Sixth Edition

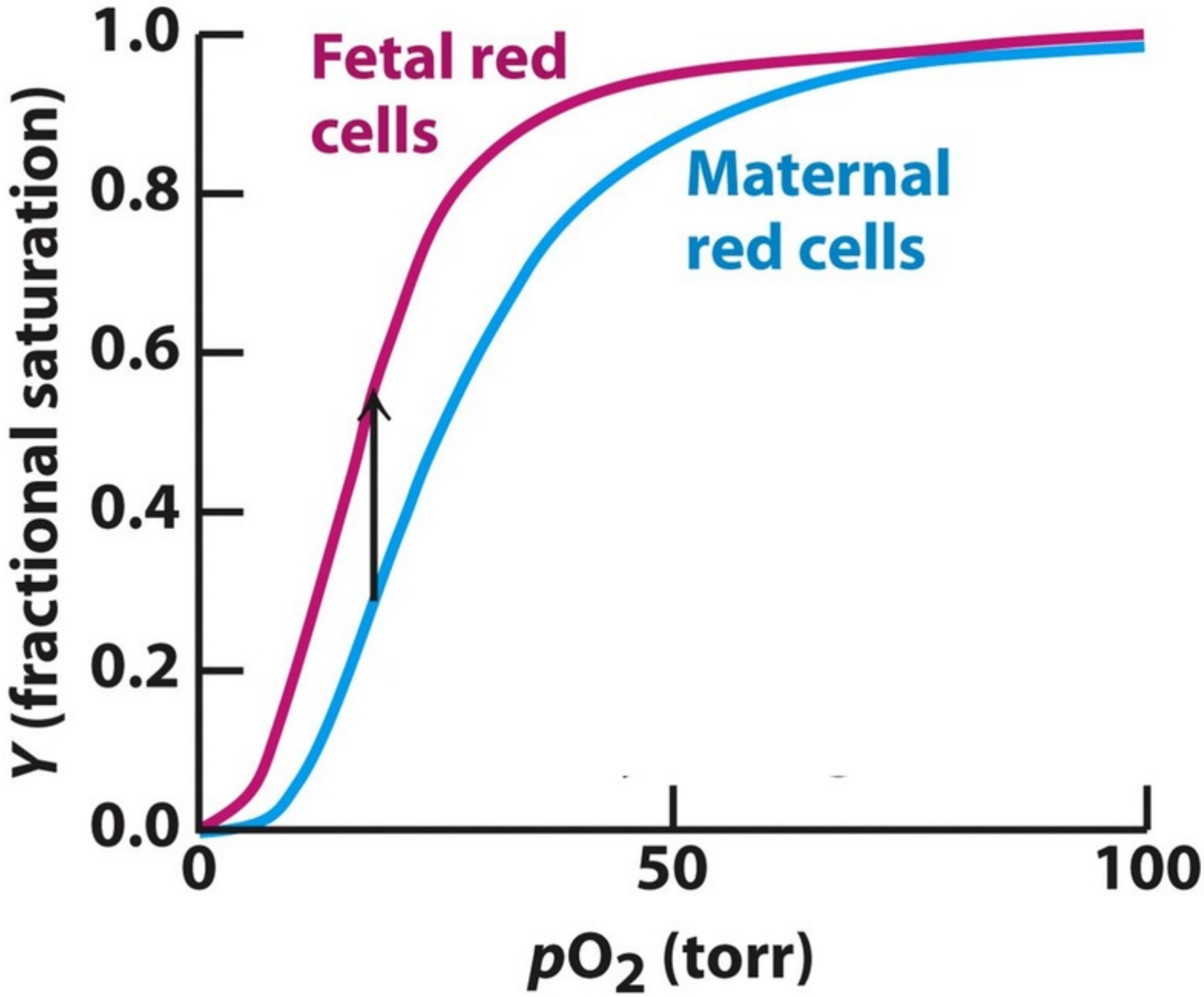
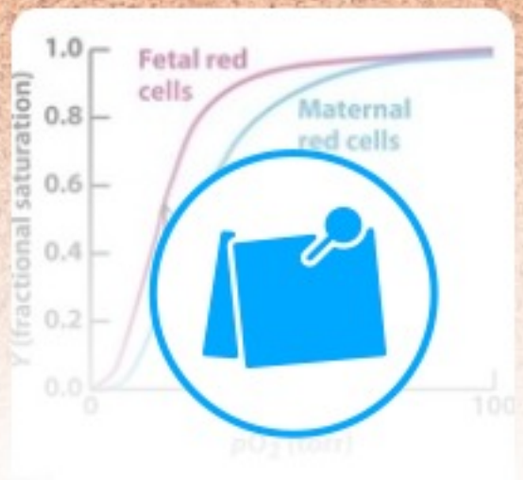
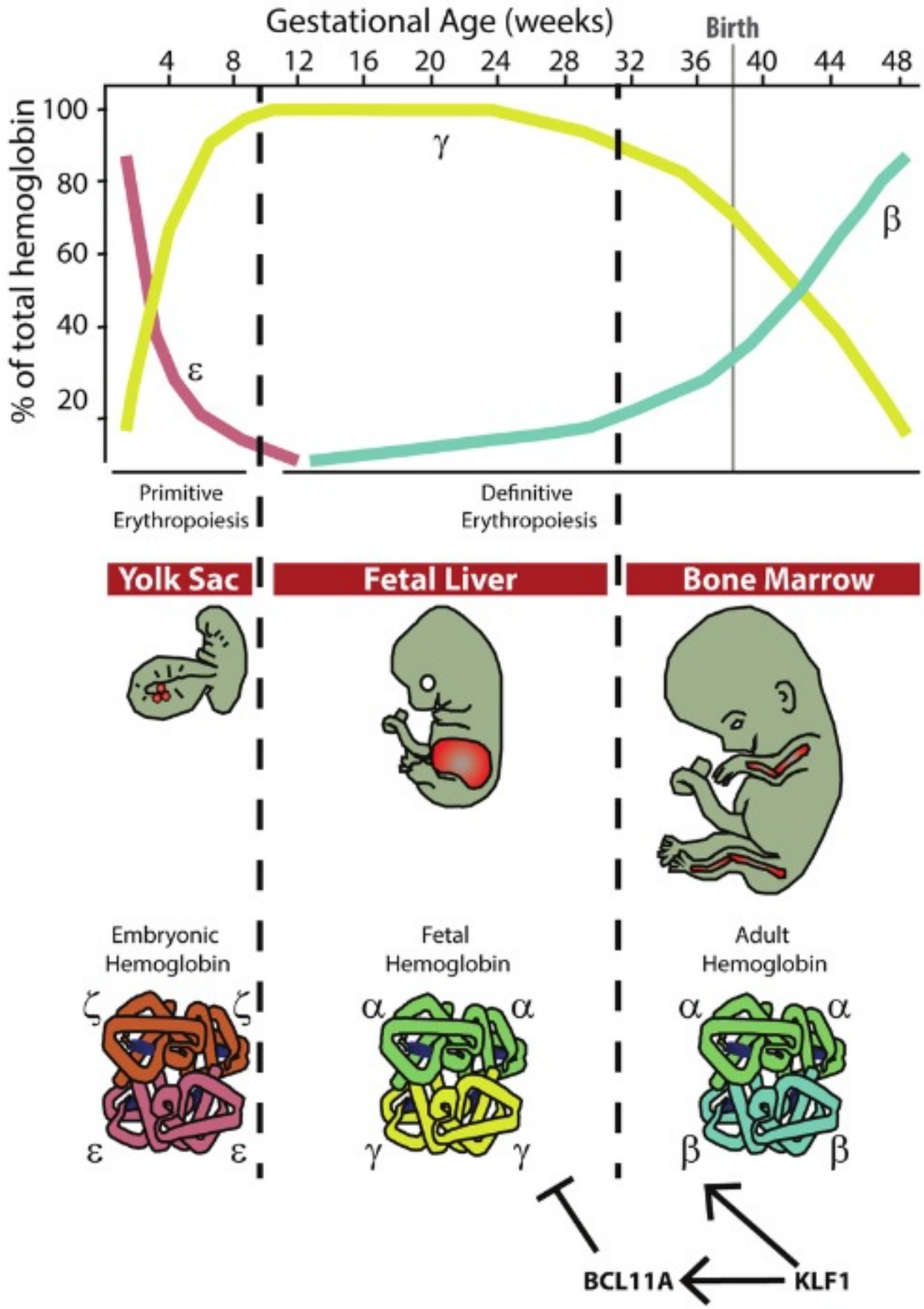


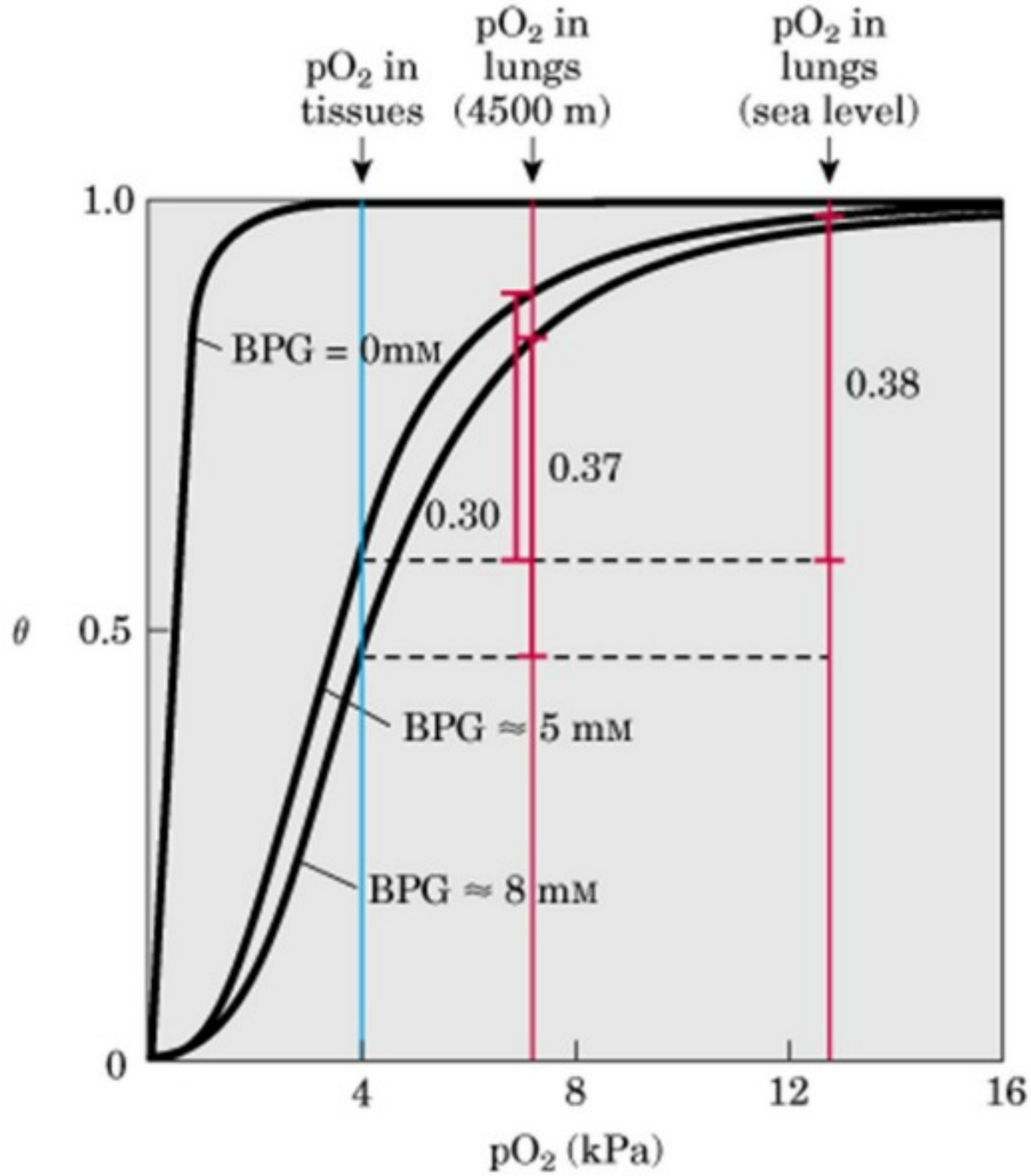
Figure 7-17
Biochemistry, Sixth Edition



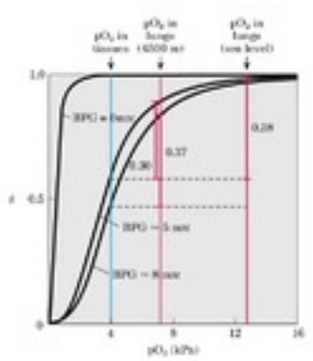
Collaborate!

Hemoglobina fetal e materna


Gestational Age (weeks)
Birth
4 8 12 16 20 24 28 32 36 40 44 48
% of total hemoglobin
100 80 60 40 20
γ
β
ε
Primitive Erythropoiesis
Definitive Erythropoiesis
Yolk Sac
Fetal Liver
Bone Marrow
Embryonic Hemoglobin
Fetal Hemoglobin
Adult Hemoglobin
ζ ζ ε ε
α α γ γ
α α β β
BCL11A
KLF1


pO2 in tissues
pO2 in lungs (4500 m)
pO2 in lungs (sea level)
1.0
0.5
0
θ
BPG = 0mM
BPG ≈ 5 mM
BPG ≈ 8 mM
0.38
0.37
0.30
4
8
12
16
pO2 (kPa)

Open Ended Question



A concentração de BPG de um indivíduo normal a nível do mar é de 5mM. Ao ser transportado para altas altitudes, após algumas horas a concentração de BPG começa a aumentar, atingindo ~8mM. Qual é o efeito deste ajuste nos níveis de BPG e a sua relevância fisiológica?

Please enter your answer here.

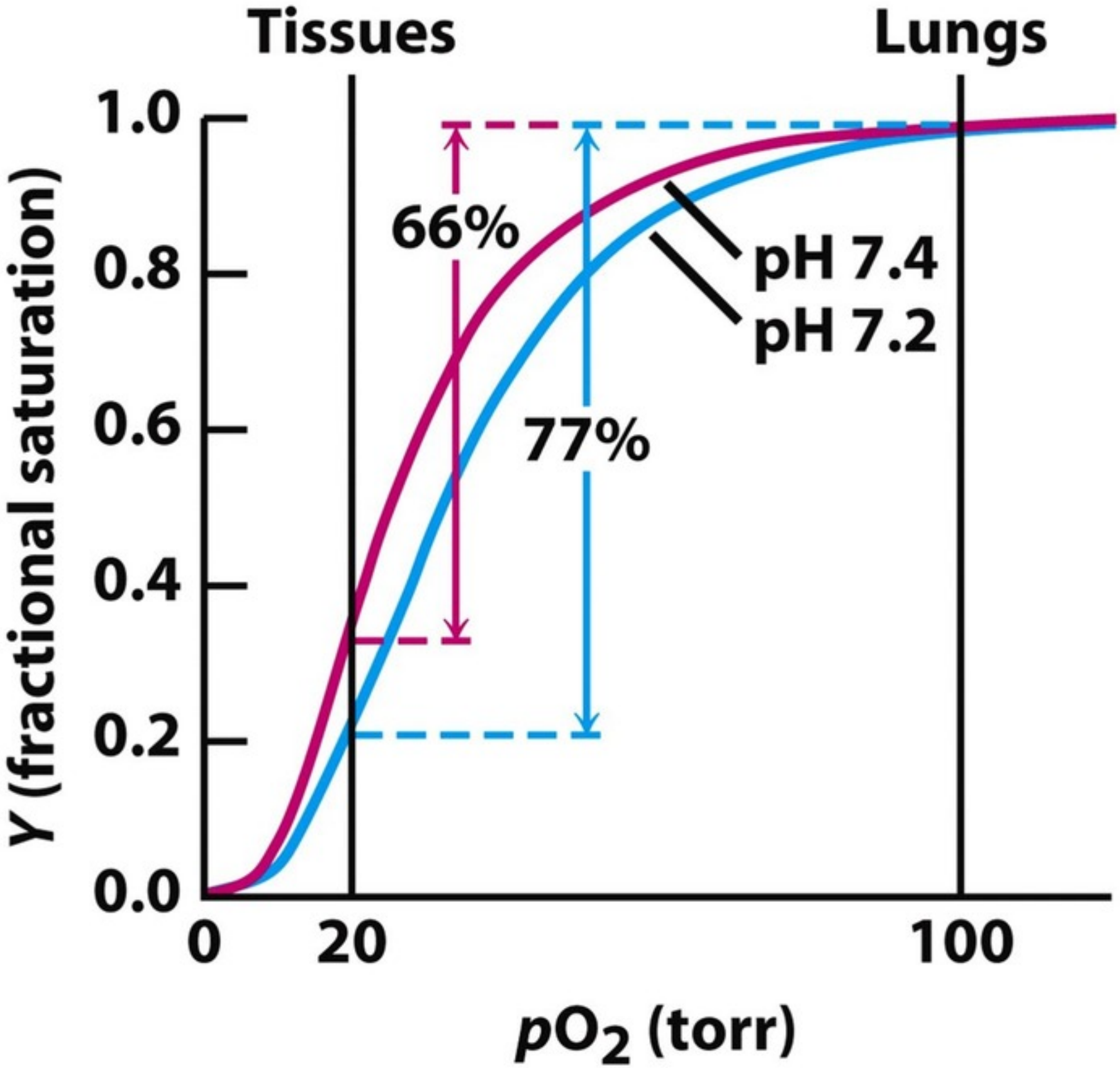


Figure 7-18
Biochemistry, Sixth Edition

Hemoglobina liga H^+ e CO_2

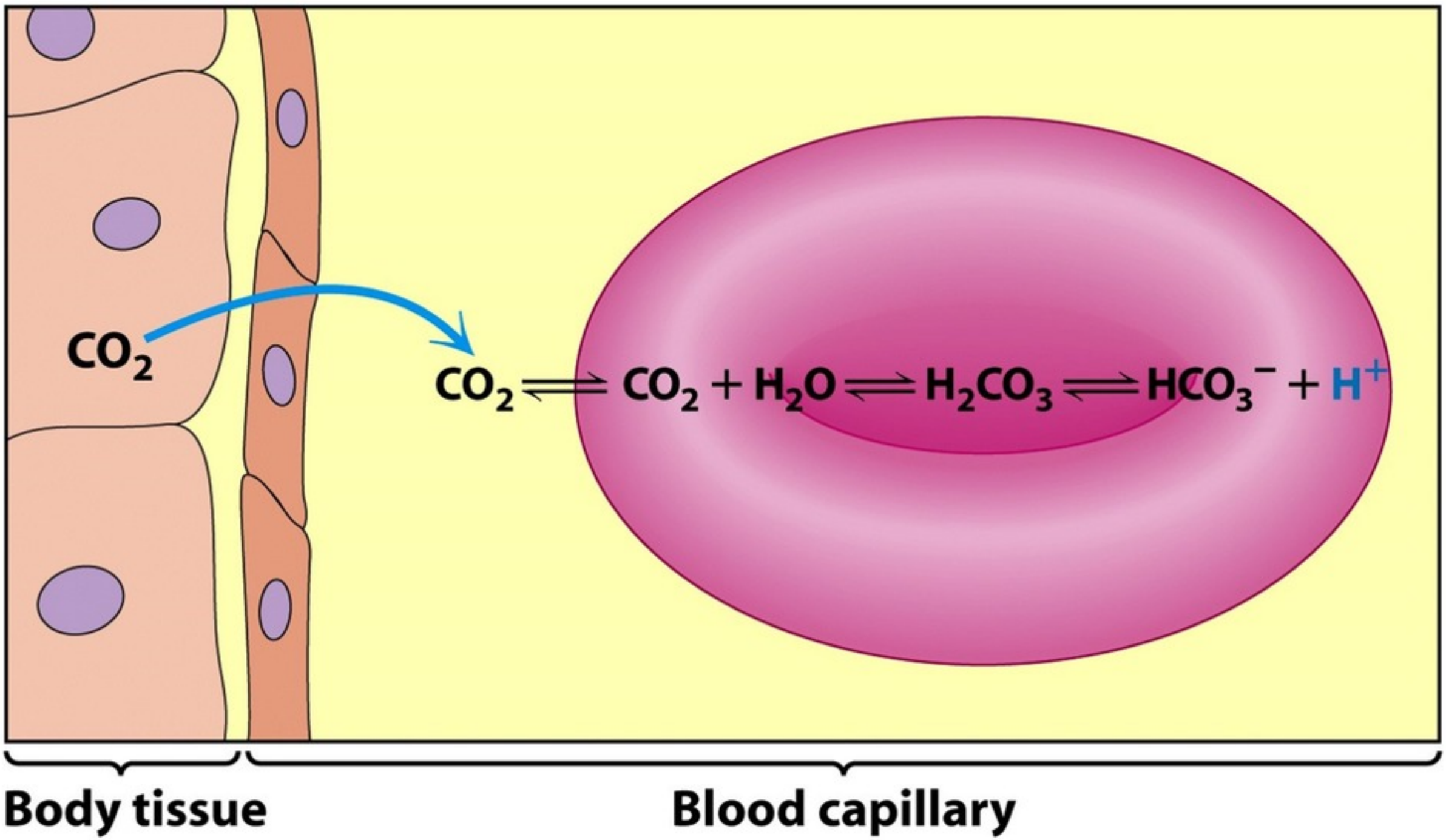


Figure 7-20
Biochemistry, Sixth Edition

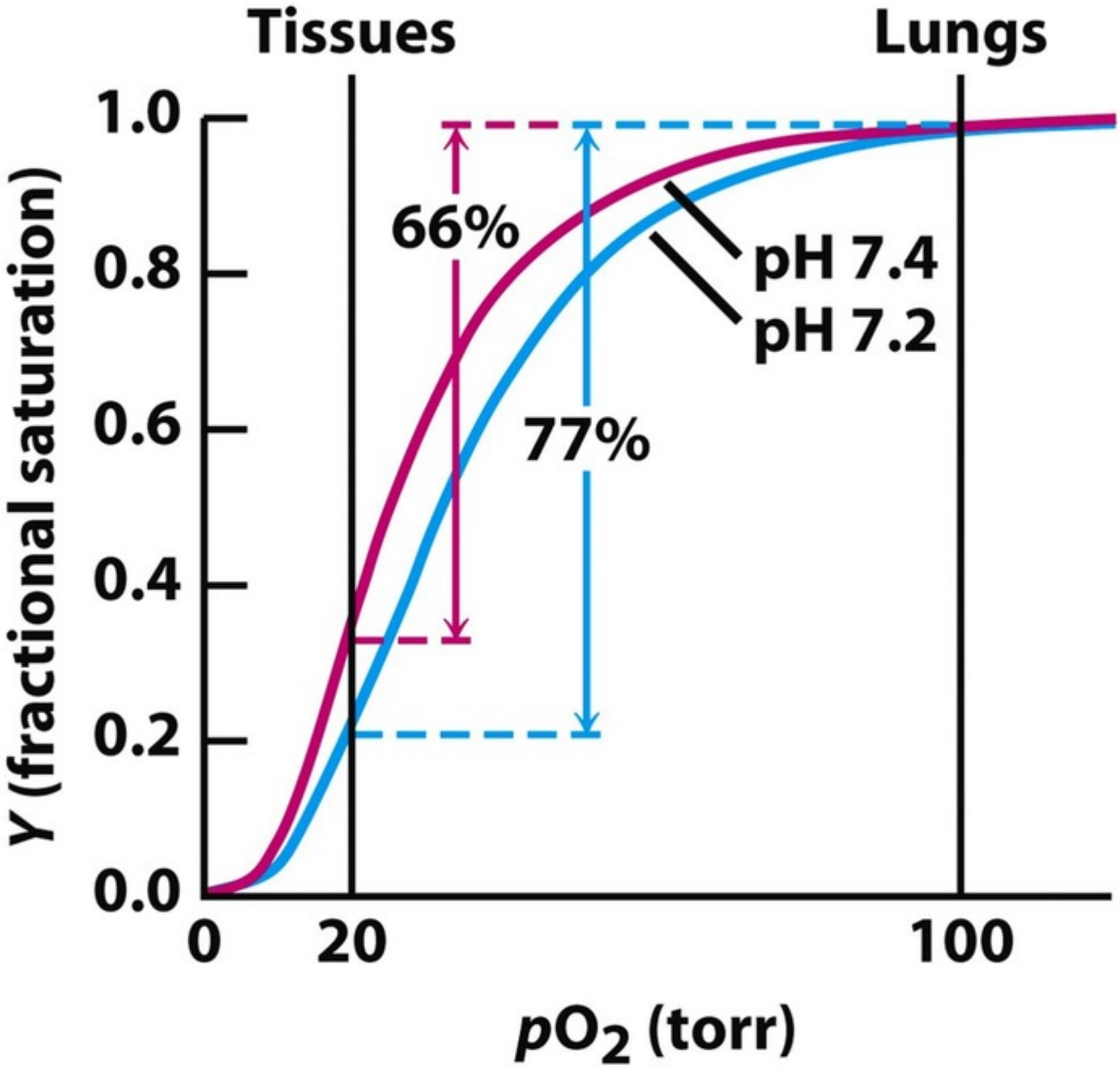


Figure 7-18
Biochemistry, Sixth Edition

Efeito Bohr:

Efeito do pH e CO_2 na liberação de O_2

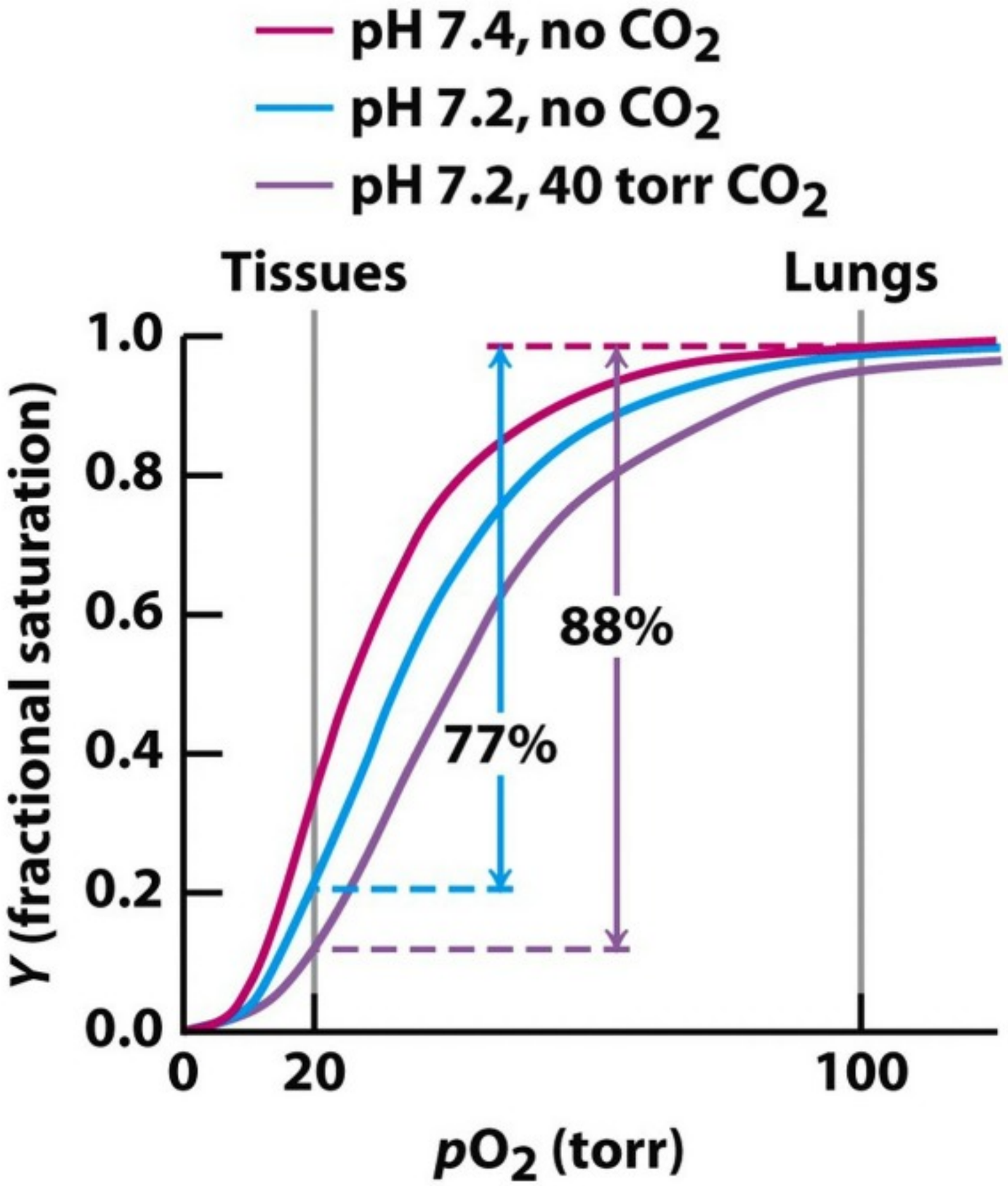
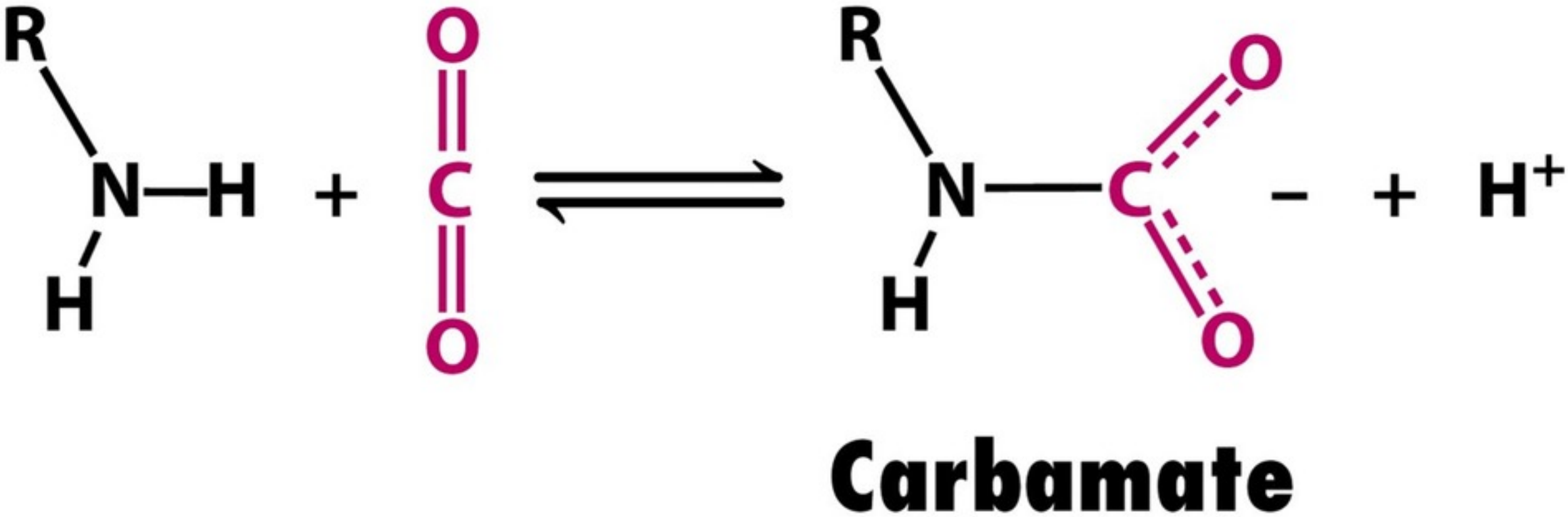


Figure 7-21
Biochemistry, Sixth Edition

O_2, H^+ e CO_2 se ligam a hemoglobina

O_2: grupo heme

H^+ : resíduos de aa da proteína – His146 – estabiliza deoxihemoglobina
CO_2 : aminas terminais da cadeia de globina – estabiliza desoxihemoglobina



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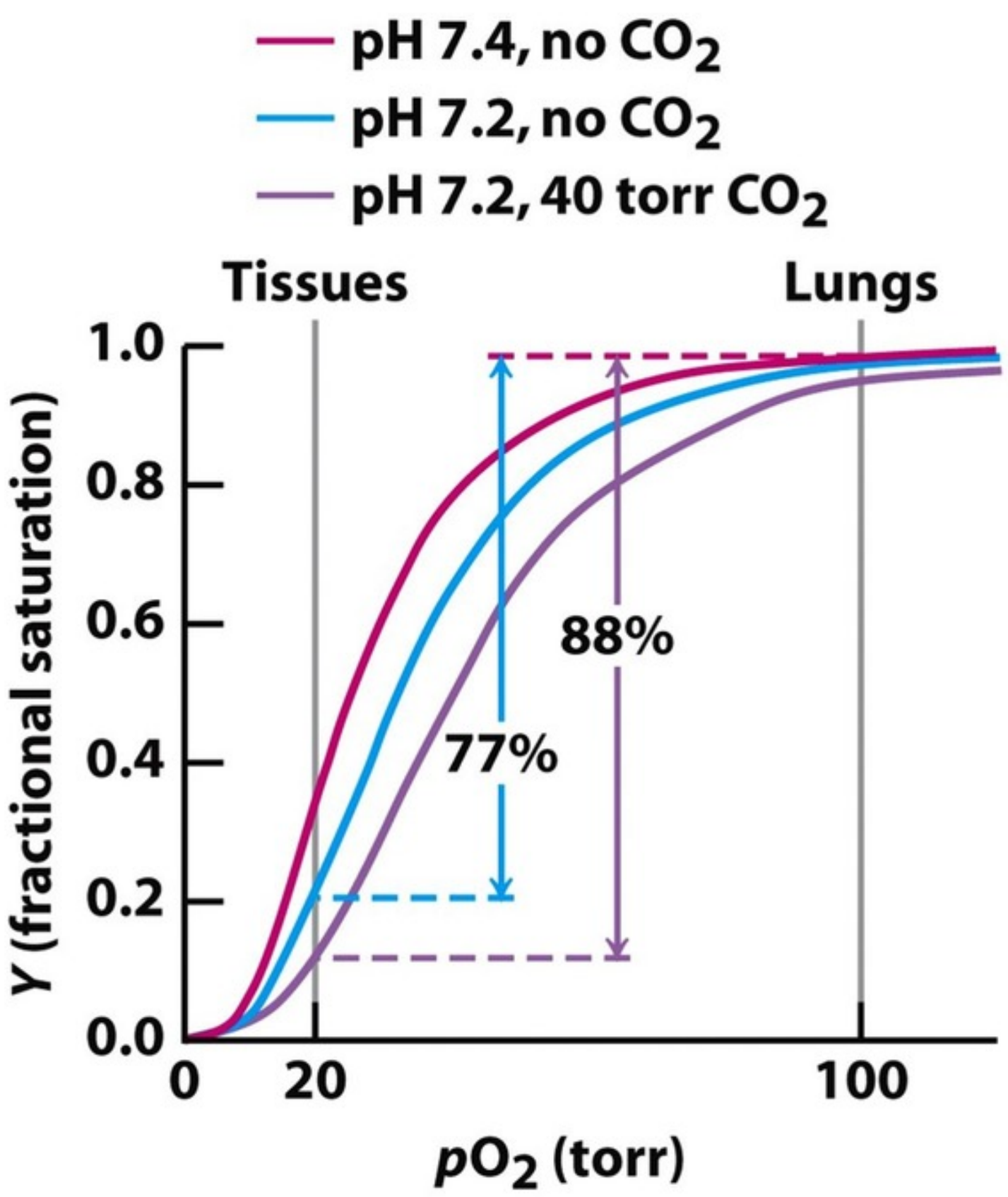

Figure 7-21
Biochemistry, Sixth Edition

Open Ended Question

O que acontece com a afinidade da hemoglobina pelo oxigênio quando há ligação de H+ e CO2? Quando CO2 é excretado e o pH do sangue aumenta, o que acontece com a afinidade da hemoglobina pelo oxigênio?

Please enter your answer here.

Oxi-Hb -→ desoxi-Hb
Captação de prótons

desoxi-Hb → oxi-Hb
Liberação de prótons

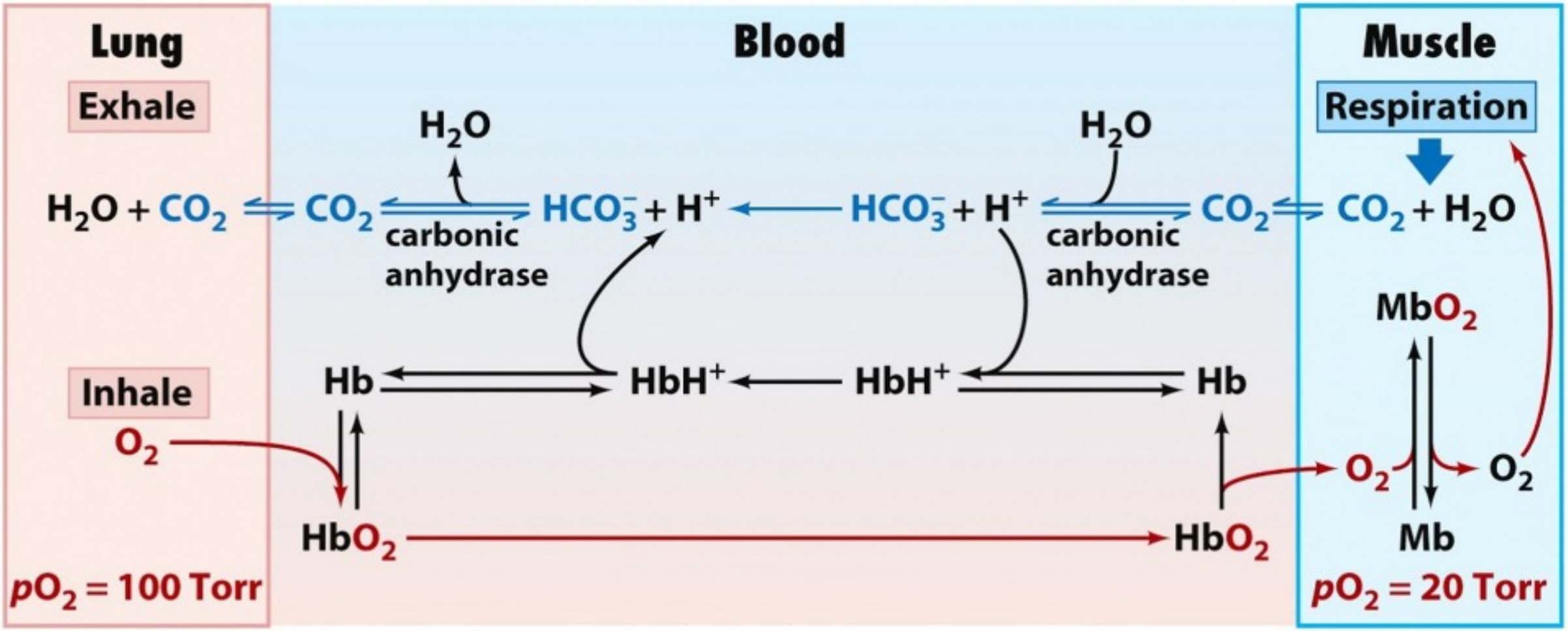

Figure 7-13 Fundamentals of Biochemistry, 2/e